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JUN 76 R J HANCOCK, F H CLEVELAND F30602-73-C-0380
UNCLASSIFIED RADC-TR-76-186-VOL-4-PT-1 NL

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Final Technical Report
June 1976

ENDO ATMOSPHERIC-EXO ATMOSPHERIC RADAR MODELING
(Appendices A-K, M)

General Dynamics

Laboratory Directors' Fund Number 01707310
with Proj. 6512 funds added.

ROME AIR DEVELOPMENT CENTER
AIR FORCE SYSTEMS COMMAND
GRIFFISS AIR FORCE BASE, NEW YORK 13441

ENDO ATMOSPHERIC-EXO ATMOSPHERIC RADAR MODELING
(APPENDICES A-K M)

This report has been reviewed by the RADC Information Office (OI) and is releasable to the National Technical Information Service (NTIS). At NTIS it will be available to the general public, including foreign nations.

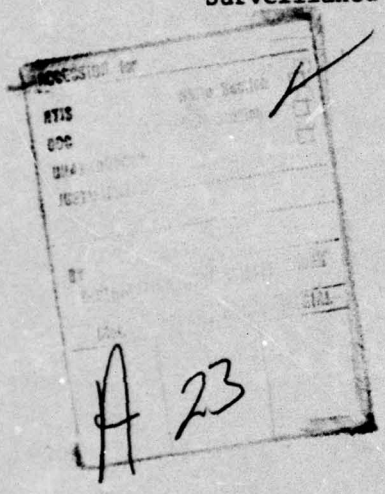
This technical report has been reviewed and is approved for publication.

APPROVED: John C. Cleary

JOHN C. CLEARY
Project Engineer

APPROVED: Moses A. Diab

MOSES A. DIAB
Acting Technical Director
Surveillance Division



FOR THE COMMANDER: John P. Huss

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Acting Chief, Plans Office

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20. ABSTRACT (Continue on reverse side if necessary and identify by block number)
This effort is concerned with the development and implementation of a set of digital computer programs that will augment the RADC digital computer radar simulation model procured under Contr F30602-72-C-0393 (01707201). The computer programs shall consist of a sequence of subroutines that correspond to separate functions such as a chaff model, target model, propagation effects and clutter model. The original radar simulation model will be expanded to include a bistatic capability and will include ECM and phase coded pulse compression

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receiver techniques. In addition, an interactive system has been designed for the simulation. Using an interactive display, an engineer would be able to understand what is happening by being able to observe results at several intermediate points in the problem. A picture is worth a thousand words. For example, an antenna pattern or waveform response to a target is more meaningful than a long table of numerical listings. Parts of the simulation were used by RADC for Deep Space Surveillance Radar (DSSR) waveform analysis, generating antenna patterns and tradeoffs involving phase shifter bit-size for the Advanced Space Defense Program (ASDP). The RADC radar simulation model is being used to support Seek Sail, Cobra Judy, Digital Coded Radar and Seek Sentry.

This report contains a large percentage of machine-produced copy which is not of the highest printing quality but because of economical consideration, it was determined in the best interest of the government that they be used in this publication.

This report contains Vol I, Pt 1 (Sections 1-7 and 9-10) (Pages 1-1 thru 1-5, 2-1 thru 2-24, 3-1 thru 3-35, 4-1 thru 4-23, 5-1 thru 5-6, 6-1 thru 6-39, 7-1 thru 7-30, 9-1 thru 9-3 and 10-1 thru 10-2).

Vol I, Pt 2 contains Section 8 (Pages 8-1 thru 8-174).

Vol I, Pt 3 contains Section 8 (Pages 8-175 thru 8-418).

Vol II, Pt 1 contains (Sections 1-8 and 10 & 11) (Pages 1-1, 2-1 thru 2-24, 3-1 thru 3-15, 4-1 thru 4-137, 5-1 thru 5-16, 6-1 thru 6-44, 7-1, 8-1 thru 8-26, 10-1 thru 10-4 and 11-1 thru 11-2).

Vol II, Pt 2 contains Sections 9 and 10 (Pages 9-1 thru 9-234 and Pages 10-1 thru 10-4).

Vol III contains Sections 1 thru 6 (Pages 1-1 thru 1-2, 2-1 thru 2-22, 3-1 thru 3-53, 4-1 thru 4-141, 5-1 thru 5-3 and 6-1).

Vol IV, Pt 1 contains Appendices A-K and Appendix M.

Vol IV, Pt 2 contains Appendix L.

BECAUSE THIS DOCUMENT IS A COMPUTER SOFTWARE PROGRAM MANY CONSECUTIVE PAGES CONTAIN ILLEGIBLE AREAS WITH VERY MINOR (1, 2 or 3 LINES) CHANGES FROM ONE PAGE TO THE NEXT. FOR THAT REASON THE OVERALL VALUE OF THE PROGRAM AFTER CONSIDERING THE LOSS OF THE ILLEGIBLE PAGES IS NOT DEGRADED TO ANY DEGREE AND THE SOFTWARE PROGRAM REMAINS CLEARLY UNDERSTANDABLE. FOR CLARIFICATION OF ANY PORTION, CONTACT RADC/OCSA.

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APPENDIX A

GLOSSARY OF ABBREVIATIONS AND SYMBOLS

CARDIN	- TSS subsystem which allows submission of batch jobs from a remote terminal.
CFG	- Simulation configuration
CPU	- Central Processor Unit. The central and arithmetic portion of a computer.
$\delta(t-t_i)$	- Dirac delta function. Unit impulse at time equal to t_i
DFT	- Discrete Fourier Transform
DSRN	- Data Set Reference Number
ECM	- Electronic Counter Measures
ECCM	- Electronic Counter Counter Measures
EDITOR	- TSS subsystem which facilitates modification or correction of TSS files
$\mathcal{F}[\ ]$	- Fourier transform operator
$\mathcal{F}^{-1}[\ ]$	- Inverse Fourier transform operator
FFT	- Fast Fourier Transform algorithm
GCOS	- Honeywell General Comprehensive Operating Supervisor
GHz (Gc)	- Gigahertz
$H[\ ]$	- Hilbert transform operator
HIS 635	- Honeywell/GE 635 computer system
IF	- Intermediate Frequency
LSB	- Least Significant Bit

LTI	-	Linear Time Invariant
MCC	-	Module Classification Code
MRN	-	Module Reference Number
MSB	-	Most Significant Bit
MTI	-	Moving Target Indication
ns (or NS)	-	nanosecond (10^{-9} second)
PASS	-	Pass through a simulation configuration
PRMFL	-	Permanent disc storage file
RADSIM	-	Radar System Simulation Model
RCS	-	Radar Cross Section
RF	-	Radio (Radiated) Frequency
RV	-	Reentry Vehicle
STF	-	Stimulus/Transfer Function
$s^*(t)$ or $S^*(f)$	-	Complex conjugate of $s(t)$ or $S(f)$
$s_*(t)$	-	A function composed of samples of $s(t)$
$S_*(f)$	-	The Fourier transform of a sampled function, such as $s_*(t)$
$\hat{s}(t)$	-	Hilbert transform of $s(t)$
$S_+(f)$	-	Positive frequency components of the signal $s(t)$
$S_-(f)$	-	Negative frequency components of the signal $s(t)$
$s_+(t)$	-	The function of time which corresponds to the positive frequency components of $s(t)$

$s_-(t)$	-	The function of time which corresponds to the negative frequency components of s(t)
$s_I(t)$	-	In-phase video channel representation of the bandlimited signal s(t)
$s_Q(t)$	-	Quadrature video channel representation of the bandlimited signal s(t)
TSS	-	Time-sharing system

APPENDIX B

SOFTWARE MODULES USED IN THE RADAR SIMULATION MODEL

The software modules used in the radar simulation module are listed herein by module name and by reference number.

B.1 SOFTWARE MODULES LISTED BY MODULE NAME

The following table includes all of the software modules listed in alphabetical order by module name. Column headings in the list are defined as follows:

1. Module Ref. Number: This is the number by which the module is called in any system model program.

2. Input: Locations where input data to module must be located before execution.

3. Output: These are the locations where output data is placed.

4. Subroutine Name: This column contains a list of subroutines used by module.

5. Subroutine PRMFL: This column contains a list of the permanent file where the subroutine is located. This file must be loaded in any system model program that uses module.

6. System Parameters: The system parameters are constants that are used in the module and are defined by module number 301, (SYS). Parameters are described in Appendix C.

7. Module Parameters: Module parameters are constants that are used in module and are defined in a namelist immediately following the module call in the system model program.

8. Comments: This column is provided for a short term description of the module.

Table B.1-1 SOFTWARE MODULES LISTED BY MODULE NAME

MODULE		ARGUMENTS		SUBROUTINES & SYMREFS REQ'D		SYSTEM PARAMETERS		MODULE NAMELIST PARAMETERS		COMMENTS
NAME	#	INPUT	OUTPUT	NAME	PRMFL	NAME	LOC	NAME	LOC	
ADDA	207	XT,XA	XT	CONV	OMISC1	-	-	-	-	ARRAY ADDITION
ADDA	239	YT,XB	YT	CONV	OMISC1	-	-	-	-	ARRAY ADDITION
ADDRND	235	XT	XT	RNDARY	OSUP2	-	-	NTYPER	45	ADD SAMPLES OF RANDOM DISTRIBUTION TO XT
				RRAND	OSUP1					
ADDRND	236	YT	YT	RNDARY	OSUP2	-	-	NTYPER	45	ADD SAMPLES OF RANDOM DISTRIBUTION TO YT
				RRAND	OSUP1					
ADRNDC	237	XT,YT	XT,YT	RNDARY	OSUP2	-	-	NTYPER	45	ADD SAMPLES OF RANDOM DISTRIBUTION TO XT+JYT
				RRAND	OSUP1					
ANTARY	413	--	XT,YT	ANTARY	OANT1	N2	1	RFFØ	3	PHASED ARRAY ANTENNA
						RFFØ	3	IDDUMP	21	
								NTSAR	76	
								DX	77	Narrow Bandwidth Waveforms
								THETAS	78	
								NROWS	79	
								NBPSCG	80	
								IRPSCG	81	
								NBPSR	82	
								IRPSR	83	
								NPULS	85	
								TSRLOS(I)	401	
ANTPAT	504	--	XT,YT	ANTARY	OANT1	N2	1	RFFØ	3	PHASED ARRAY FAR FIELD PATTERN GENERATION
						RFFØ	3	IDDUMP	21	Output independent variable = Sine θ
				ZFFT	OZFFT			NTSAR	76	
								DX	77	
								THETAS	78	Narrow bandwidth waveforms
								NROWS	79	
								NBPSCG	80	
								IRPSCG	81	
								NBPSR	82	
								IRPSR	83	
								INORM	84	
								NPULS	85	
								TSRLOS(I)	401	
ATOD	216	XT	IXT	ATOD	ODFIN	-	-	XLSB	103	ANALOG TO DIGITAL CONVERTER
								NBITS	104	
								IROFF	105	
								ADCFS	149	
ATOD	217	YT	IYT	ATOD	ODFIN	-	-	XLSB	103	ANALOG TO DIGITAL CONVERTER
								NBITS	104	
								IROFF	105	
								ADCFS	149	

MODULE		ARGUMENTS		SUBROUTINES & SYMREFS REQ'D		SYSTEM PARAMETERS		MODULE NAMELIST PARAMETERS		COMMENTS
NAME	#	INPUT	OUTPUT	NAME	PRMFL	NAME	LOC	NAME	LOC	
CDFNCL	404	XT,YT	XT,YT	CDIGFL	ODFIN	-	-	FFR	68	DIGITAL FILTER-COMPLEX
								FFI	69	Storage resisters not zeroed
								FBR	70	
								FBI	71	
CDIGFL	403	XT,YT	XT,YT	CDIGFL	ODFIN	-	-	FFR	68	DIGITAL FILTER-COMPLEX
								FFI	69	Storage resisters zeroed
								FBR	70	
								FBI	71	
CFAR	459	XT	XA	CFAR	OMISC1	TI	12	TAVG	198	CONSTANT FALSE ALARM RATE PROCESSOR
CFAR	460	YT	XB	CFAR	OMISC1	TI	12	TAVG	198	CONSTANT FALSE ALARM RATE PROCESSOR
CGEN	425	--	XT,YT	CGEN	OTSAR	RFFØ	3	RFFØ	3	TSAR CONTROL GENERATOR
			(XA)*			SIMFØ	8	IDDUMP	21	
				FGENMP	OXMTR2	TI	12	DX	77	* Array XA used for scratch storage
				DFT	OMISC2			THETAS	78	
								NROWS	79	
				SHIFTS	OMISC1			NBPSCG	80	
								IRPSCG	81	
								NPULS	85	
								NCGPLS	88	
								TCGNOM	89	
								FMBW	93	
								NPWTX	94	
								RISTIM	98	
								FALTIM	99	
								TIMLSB	115	
								WTX(I,J)	201	
CGENCW	455	--	XT,YT	CGENSF	OTSAR1	RFFØ	3	DX	77	FSAR CONTROL GENERATOR FOR FREQUENCY SCANNED
						SIMFØ	8	THETAS	78	PHASED ARRAY
								NROWS	79	
								TCGNOM	89	
CGENSF	453	--	XT,YT	CGENSF	OTSAR1	RFFØ	3	RFFØ	3	CONTROL GENERATOR - BURST
						SIMFØ	8	DX	77	Pulse to pulse phase shift deleted
								THETAS	78	
								NROWS	79	
								NCGPLS	88	
								TCGNOM	89	
CLINT	302	--	--	CLINT	OCLINT	TI	12	RNGCEL	14	CLUTTER MODEL INITIALIZER
						LAMBDA	13	IDDUMP	21	
						RNGCEL	14	NRCS	46	
								RWPH	48	
								WNDVEL	49	
								VELANG	50	

MODULE		ARGUMENTS		SUBROUTINES & SYMREFS REQ'D		SYSTEM PARAMETERS		MODULE NAMELIST PARAMETERS		COMMENTS
NAME	#	INPUT	OUTPUT	NAME	PRMFL	NAME	LOC	NAME	LOC	
CLINT(cont.)								RNEXT	51	
								RNØ	52	
								AZEXT	53	
								AZØ	54	
								MM	55	
								ELEXT	56	
								ELØ	57	
								NN	58	
CLUTTR	503	--	XT,YT (XB)*	CLUTTR	OTGCL	TIME	16	-	-	CLUTTER MODEL (Initialized by CLINT) * Array XB used for scratch storage
				AZGAIN	OSUP2	FS	2			
				ELGAIN	OSUP2	RNGCEL	14			
						TI	12			
CUMDIS	208	XT	XA	CUMDIS	OSUP2	-	-	TLIM	39	HISTOGRAM GENERATION
								BLIM	40	
								NHIST	41	
								NCPACK	42	
								NDPACK	43	
CUMDIS	209	YT	XA	CUMDIS	OSUP2	-	-	TLIM	39	HISTOGRAM GENERATION
								BLIM	40	
								NHIST	41	
								NCPACK	42	
								NDPACK	43	
CONV	204	XT,YT, XA,XB	XT,YT	CONV	OMISC1	-	-	-	-	ARRAY MULTIPLICATION Complex rectangular
CONVMP	205	XT,YT, XA,XB	XT,YT	CONV	OMISC1	-	-	-	-	ARRAY MULTIPLICATION Complex polar
(DATA XFER)	114	XT,YT	XA,XB	DBLKX	OSUP1	-	-	-	-	
(DATA XFER)	115	XA,XB	XT,YT	DBLKX	OSUP1	-	-	-	-	
DCFAR	440	IXT	IXT	DCFAR	ODFIN	-	-	NCELL	170	DIGITAL CFAR VIDEO PROCESSOR
DCFAR	441	IYT	IYT	DCFAR	ODFIN	-	-	NCELL	170	DIGITAL CFAR VIDEO PROCESSOR
DFT	201	--	XT,YT	DFT	OMISC2	NORMFT	9	SIMBW	4	DISCRETE FOURIER TRANSFORM Video data
						FI	11	IDDUMP	21	
						TI	12	NIMP	200	
						SIMBW	4	DFTIN(I,J)	201	

MODULE		ARGUMENTS		SUBROUTINES & SYMREFS REQ'D		SYSTEM PARAMETERS		MODULE NAMELIST PARAMETERS		COMMENTS
NAME	#	INPUT	OUTPUT	NAME	PRMFL	NAME	LOC	NAME	LOC	
DFTFØ	234	--	XT,YT	DFT	OMISC2	NORMFT	9	SIMBW	4	DISCRETE FOURIER TRANSFORM
						FI	11	SIMFØ	8	Intermediate Frequency(IF) data
						TI	12	IDDUMP	21	
						SIMBW	4	NIMP	200	
						SIMFØ	8	DFTIN(I,J)	201	
DFTRF	233	-	XT,YT	DFT	OMISC1	NORMFT	9	RFFØ	3	DISCRETE FOURIER TRANSFORM
						FI	11	SIMBW	4	Radio Frequency(RF) data
						TI	12	IDDUMP	21	
						SIMBW	4	NIMP	200	
						RFFØ	3	DFTIN(I,J)	201	
DIGFSF	463	XT,YT	XT,YT	DIGFSF	ODFIN	-	-	RADIUS	195	DIGITAL FILTER-FREQUENCY SAMPLING DESIGN
								NSAM	196	Low pass filter only
								NDFZ	197	
								FSAM(I,J)	201	
DIGFIL	461	XT,YT	XT,YT	DIGFIL	ODFIN	-	-	SF	74	DIGITAL FILTER-MULTIPLE SECTION
								NSEC	199	Storage registers zeroed
								FBCOEF(IJ)	201	
								FFCOEF(I,J)	251	
DIGFNC	462	XT,YT	XT,YT	DIGFIL	ODFIN	-	-	SF	74	DIGITAL FILTER-MULTIPLE SECTION
								NSEC	199	Storage registers not zeroed
								FBCOEF(I,J)	201	
								FFCOEF(I,J)	251	
DIGTFL	422	IXT	IXT	DIGTFL	ODFIN	-	-	NTAPS	101	DIGITAL TRANSVERSAL FILTER
								ITAP(I,J)	201	
DIGTFL	423	IYT	IYT	DIGTFL	ODFIN	-	-	NTAPS	101	DIGITAL TRANSVERSAL FILTER
								ITAP(I,J)	201	
DIVA	206	XT,YT, XA,XB	XT,YT	CONV	OMISC1	-	-	-	-	COMPLEX POLAR ARRAY DIVISION
DTOA	218	IXT	XT	ATOD	ODFIN	-	-	-	-	DIGITAL TO ANALOG CONVERSION
DTOA	219	IYT	YT	ATOD	ODFIN	-	-	-	-	DIGITAL TO ANALOG CONVERSION
DTOA	220	IYT	XA	ATOD	ODFIN	-	-	-	-	DIGITAL TO ANALOG CONVERSION
DTOA	228	IXT	XA	ATOD	ODFIN	-	-	-	-	DIGITAL TO ANALOG CONVERSION
ECM	512	XT,YT	XT,YT	ECM	ODFIN	N2	1	JVEL	156	NOISE JAMMER
				DIGFSF	ODFIN	TIME	16	JPEROD	157	
								JRNG	171	
								JRSIM	172	
								JMAZ	173	

MODULE		ARGUMENTS		SUBROUTINES & SYMREFS REQ'D		SYSTEM PARAMETERS		MODULE NAMELIST PARAMETERS		COMMENTS
NAME	#	INPUT	OUTPUT	NAME	PRMFL	NAME	LOC	NAME	LOC	
ECM(cont.)								JHGT	174	
								JERP	175	
								JFMBW	176	
								JPW	177	
								JFØ	178	
								RADIUS	195	
								NSAM	196	
								NDFZ	197	
								FSAM(I,J)	201	
ERGYCP	118	XT,YT	SYSOUT	ERGYCP	OMISC1	-	-	-	-	ENERGY CONTAINED IN A WAVEFORM
ERGYRE	116	XT	SYSOUT	ERGYCP	OMISC1	-	-	-	-	ENERGY CONTAINED IN A WAVEFORM
ERGYRE	117	YT	SYSOUT	ERGYCP	OMISC1	-	-	-	-	ENERGY CONTAINED IN A WAVEFORM
FGENMP	421	--	XT,YT	FGENXY	OXMTR2	N2	1	SIMFØ	8	TRANSMITTER-COMPLEX POLAR OUTPUT
						FS	2	IDDUMP	21	
						TI	12	PW	90	
						SIMFØ	8	FMBW	93	
						NORMFT	9	NPWTX	94	
								SPW	95	
								NSUBP	96	
								SWTIM	97	
								RISTIM	98	
								FALTIM	99	
								TSTART	100	
								WTX(I,J)	201	
								PCODE(I)	451	
								CHIRP	92	
								VPEAK	129	
								FSTRT	91	
FGENXY	420	--	XT,YT	FGENXY	OXMTR2	N2	1	SIMFØ	8	TRANSMITTER-COMPLEX RECTANGULAR OUTPUT
						FS	2	IDDUMP	21	
						TI	12	PW	90	
						SIMFØ	8	FMBW	93	
						NORMFT	9	NPWTX	94	
								SPW	95	
								NSUBP	96	
								SWTIM	97	
								RISTIM	98	
								FALTIM	99	
								TSTART	100	
								WTX(I,J)	201	
								PCODE(I)	451	
								CHIRP	92	
								FSTRT	91	
								VPEAK	129	

MODULE		ARGUMENTS		SUBROUTINES & SYMREFS REQ'D		SYSTEM PARAMETERS		MODULE NAMELIST PARAMETERS		COMMENTS
NAME	#	INPUT	OUTPUT	NAME	PRMFL	NAME	LOC	NAME	LOC	
FILT	407	XT,YT	XT,YT	FILT	OMISC1	-	-	NZ	72	TRANSFER FUNCTION SPECIFIED IN S-PLANE
								NP	73	
								SF	74	
								FZERO(I,J)	201	
								FPOLE(I,J)	301	
FILT	408	XA,XB	XA,XB	FILT	OMISC1	-	-	NZ	72	TRANSFER FUNCTION SPECIFIED IN S-PLANE
								NP	73	
								SF	74	
								FZERO(I,J)	201	
								FPOLE(I,J)	301	
FWDET	416	XT	XT	HWDET	OMISC2	-	-	-	-	FULL-WAVE DETECTOR
FWDET	417	YT	YT	HWDET	OMISC2	-	-	-	-	FULL-WAVE DETECTOR
HLIM	438	XT	XT	HWDET	OMISC2	-	-	-	-	HARD LIMITER
HLIM	439	YT	YT	HWDET	OMISC2	-	-	-	-	HARD LIMITER
HWDET	414	XT	XT	HWDET	OMISC2	-	-	-	-	HALF-WAVE DETECTOR
HWDET	415	YT	YT	HWDET	OMISC2	-	-	-	-	HALF-WAVE DETECTOR
IFWDET	447	IXT	IXT	HWDET	OMISC2	-	-	-	-	DIGITAL FULL-WAVE DETECTOR
IFWDET	448	IYT	IYT	HWDET	OMISC2	-	-	-	-	DIGITAL FULL-WAVE DETECTOR
IHLIM	442	IXT	IXT	HWDET	OMISC2	-	-	-	-	DIGITAL HARD LIMITER
IHLIM	443	IYT	IYT	HWDET	OMISC2	-	-	-	-	DIGITAL HARD LIMITER
IHWDET	445	IXT	IXT	HWDET	OMISC2	-	-	-	-	DIGITAL HALF-WAVE DETECTOR
IHWDET	446	IYT	IYT	HWDET	OMISC2	-	-	-	-	DIGITAL HALF-WAVE DETECTOR
INGTOR	409	XT	XT	INGTOR	ODFIN	-	-	FBCK	75	INTEGRATOR
INGTOR	410	YT	YT	INGTOR	ODFIN	-	-	FBCK	75	INTEGRATOR
IONOS	511	XT,YT	XT,YT	IONOS	OTGCL	RFFØ	3	SEDENS	148	IONOSPHERIC DISPERSION EFFECTS
ISQDET	449	IXT	IXT	HWDET	OMISC2	-	-	-	-	DIGITAL SQUARE LAW DEVICE
ISQDET	450	IYT	IYT	HWDET	OMISC2	-	-	-	-	DIGITAL SQUARE LAW DEVICE
LAMPCP	458	XT,YT	XT,YT	LAMPCP	OMISC1	-	-	GAIN	145	LINEAR AMPLIFIER
LAMPRE	456	XT	XT	LAMPCP	OMISC1	-	-	GAIN	145	LINEAR AMPLIFIER

MODULE		ARGUMENTS		SUBROUTINES & SYMREFS REQ'D		SYSTEM PARAMETERS		MODULE NAMELIST PARAMETERS		COMMENTS
NAME	#	INPUT	OUTPUT	NAME	PRMFL	NAME	LOC	NAME	LOC	
LAMPRE	457	YT	YT	LAMPCP	OMISC1	-	-	GAIN	145	LINEAR AMPLIFIER
MTIFLT	430	XT or IXT*	XT or IXT*	MTIFLT	ODIG	-	-	FF0	68	DOUBLE DELAY MTI FILTER
								FF1	69	Delay line storage zeroed
								FB1	70	
								FB2	71	* XT used for MODEDF=1 (Floating point arithmetic)
								IFF0N	160	
								IFF0D	161	IXT used for MODEDF=2 (Integer arithmetic)
								IFF1N	162	
								IFF1D	163	
								IFB1N	164	
								IFB1D	165	
								IFB2N	166	
								IFB2D	167	
								MODEDF	168	
								NBITDF	169	
MTIFLT	431	YT or IYT*	YT or IYT*	MTIFLT	ODIG	-	-	FF0	68	DOUBLE DELAY MTI FILTER
								FF1	69	Delay line storage zeroed
								FB1	70	
								FB2	71	* YT used for MODEDF=1 (Floating point arithmetic)
								IFF0N	160	
								IFF0D	161	IYT used for MODEDF=2 (Integer arithmetic)
								IFF1N	162	
								IFF1D	163	
								IFB1N	164	
								IFB1D	165	
								IFB2N	166	
								IFB2D	167	
								MODEDF	168	
								NBITDF	169	
MTINCL	432	XT or IXT*	XT or IXT*	MTIFLT	ODIG	-	-	FF0	68	DOUBLE DELAY MTI FILTER
								FF1	69	Delay line storage not zeroed
								FB1	70	
								FB2	71	* XT used for MODEDF=1 (Floating point arithmetic)
								IFF0N	160	
								IFF0D	161	IXT used for MODEDF=2 (Integer arithmetic)
								IFF1N	162	
								IFF1D	163	
								IFB1N	164	
								IFB1D	165	
								IFB2N	166	
								IFB2D	167	
								MODEDF	168	
								NBITDF	169	

MODULE		ARGUMENTS		SUBROUTINES & SYMREFS REQ'D		SYSTEM PARAMETERS		MODULE NAMELIST PARAMETERS		COMMENTS
NAME	#	INPUT	OUTPUT	NAME	FRMFL	NAME	LOC	NAME	LOC	
MTIDLI	435	XI or IYI*	YI or IYI*	MTIFLT	ODIG	-	-	FFØ FF1 FB1 FB2 IFFØN IFFØD IFF1N IFF1D IFB1N IFB1D IFB2N IFB2D MODEDF NBITDF	68 69 70 71 160 161 162 163 164 165 166 167 168 169	DOUBLE DELAY MTI FILTER Delay line storage not zeroed * YI used for MODEDF=1 (Floating point arithmetic) IYI used for MODEDF=2 (Integer arithmetic)
NCSWPI	436	XI	XI	SWPINT	ODIG	-	-	FBCK	75	SWEEP INTEGRATOR Delay line storage not zeroed
NCSWPI	437	YI	YI	SWPINT	ODIG	-	-	FBCK	75	SWEEP INTEGRATOR Delay line storage not zeroed
NONLIN	401	XI	XI	NONLIN	OMISC2	-	-	NTFN TFN(I,J)	67 201	NON-LINEAR TRANSFER FUNCTION
NONLIN	402	YI	YI	NONLIN	OMISC2	-	-	NTFN TFN(I,J)	67 201	NON-LINEAR TRANSFER FUNCTION
OUTCUM	210	XA	XB	CUMDIS	OSUP2	-	-	NCPACK	42	CUMULATIVE DISTRIBUTION CALCULATION
OUTCUM	211	XA	XA	CUMDIS	OSUP2	-	-	NCPACK	42	CUMULATIVE DISTRIBUTION CALCULATION
PDF	212	XA	XB	CUMDIS	OSUP2	-	-	NDPACK	43	PROBABILITY DENSITY FUNCTION CALCULATION
PDF	213	XA	XA	CUMDIS	OSUP2	-	-	NDPACK	43	PROBABILITY DENSITY FUNCTION CALCULATION
PHDEC	508	-	XI,YI	PHDEC DFT	OXMIR2 OMISC1	SIMFØ NORMFT	8 9	FØDEC TAPSPC INPTF	102 154 155	ANALOG PHASE DECODER TRANSFER FUNCTION If no input data is specified (INPTF=0) this module is slaved to PHENC or FGENXY
PHDEC	509	-	XA,XB	PHDEC DFT	OXMIR2 OMISC1	SIMFØ NORMFT	8 9	FØDEC TAPSPC INPTF	102 154 155	ANALOG PHASE DECODER TRANSFER FUNCTION If no input data is specified (INPTF=0) this module is slaved to PHENC or FGENXY
PHENC	506	-	XI,YI	PHENC FGENXY	OXMIR1 OXMIR2	N2 FS TI SIMFØ NORMFT	1 2 12 8 9	NSR MODEPH IPY(I) ICODE CHIRP FSTRT	184 183 186 194 92 91	PHASE ENCODED TRANSMITTER Complex rectangular output

MODULE		ARGUMENTS		SUBROUTINES & SYMREFS REQ'D		SYSTEM PARAMETERS		MODULE NAMELIST PARAMETERS		COMMENTS
NAME	#	INPUT	OUTPUT	NAME	PRMFL	NAME	LOC	NAME	LOC	
PHENC(cont.)								SPW	95	
								NSUBP	96	
								SWTIM	97	
								TSTART	100	
								SIMFØ	8	
								VPEAK	129	
								RISTIM	98	
								FALTIM	99	
PHENC	507	-	XT,YT	PHENC	OXMTR1	N2	1	NSR	184	PHASE ENCODED TRANSMITTER
				FGENXY	OXMTR2	FS	2	MODEPH	183	Complex polar output
						TI	12	IPY(I)	186	
						SIMFØ	8	ICODE	194	
						NORMFT	9	CHIRP	92	
								FSTRT	91	
								SPW	95	
								NSUBP	96	
								SWTIM	97	
								TSTART	100	
								SIMFØ	8	
								VPEAK	129	
								RISTIM	98	
								FALTIM	99	
PLOTTR	307	XT	PRMFL OR MAG TAPE	PLOTTR	OPLOTS	-	-	ST	59	OUTPUT DATA FOR OFF-LINE PLOTTER
								RNG	60	Floating point format
								NSKP	63	
								IFCODE	113	
								VIL(I)	201	
								VDL(I)	251	
								GLBL(I)	301	
PLOTTR	308	YT	PRMFL OR MAG TAPE	PLOTTR	OPLOTS	-	-	ST	59	OUTPUT DATA FOR OFF-LINE PLOTTER
								RNG	60	Floating point format
								NSKP	63	
								IFCODE	113	
								VIL(I)	201	
								VDL(I)	251	
								GLBL(I)	301	
PLOTTR	309	XA	PRMFL OR MAG TAPE	PLOTTR	OPLOTS	-	-	ST	59	OUTPUT DATA FOR OFF-LINE PLOTTER
								RNG	60	Floating point format
								NSKP	63	
								IFCODE	113	
								VIL(I)	201	
								VDL(I)	251	
								GLBL(I)	301	

MODULE		ARGUMENTS		SUBROUTINES & SYMREFS REQ'D		SYSTEM PARAMETERS		MODULE NAMELIST PARAMETERS		COMMENTS
NAME	#	INPUT	OUTPUT	NAME	PRMFL	NAME	LOC	NAME	LOC	
PLOTTR	310	XB	PRMFL OR MAG TAPE	PLOTTR	OPLOTS	-	-	ST RNG NSKP IFCODE VIL(I) VDL(I) GLBL(I)	59 60 63 113 201 251 301	OUTPUT DATA FOR OFF-LINE PLOTTER Floating point format
PLTFMT	113	XT,YT	XA	PLTFMT	OANT1	-	-	ADELT ASTRT ASTOP	33 34 35	TRANSFORMATION OF DATA IN SINE SPACE TO ANGLE SPACE Output data in dB
PTLIST	303	XT	PRMFL	PTLIST	OPLOTS	-	-	ST RNG LF NSKP NAUTO TH TL IFCODE VDL(I)	59 60 62 63 64 65 66 113 251	OUTPUT DATA FOR OFF-LINE PLOTTER Integer format-13 Bit accuracy
PTLIST	304	YT	PRMFL	PTLIST	OPLOTS	-	-	ST RNG LF NSKP NAUTO TH TL IFCODE VDL(I)	59 60 62 63 64 65 66 113 251	OUTPUT DATA FOR OFF-LINE PLOTTER Integer format-13 Bit accuracy
PTLIST	305	XA	PRMFL	PTLIST	OPLOTS	-	-	ST RNG LF NSKP NAUTO TH TL IFCODE VDL(I)	59 60 62 63 64 65 66 113 251	OUTPUT DATA FOR OFF-LINE PLOTTER Integer format-13 Bit accuracy
PTLIST	306	XB	PRMFL	PTLIST	OPLOTS	-	-	ST RNG LF NSKP NAUTO TH TL	59 60 62 63 64 65 66	OUTPUT DATA FOR OFF-LINE PLOTTER Integer format-13 Bit accuracy

MODULE		ARGUMENTS		SUBROUTINES & SYMREFS REQ'D		SYSTEM PARAMETERS		MODULE NAMELIST PARAMETERS		COMMENTS
NAME	#	INPUT	OUTPUT	NAME	PRMFL	NAME	LOC	NAME	LOC	
PTLIST(cont.)								IFCODE	113	
								VDL(I)	251	
PXFRM	454	--	XT,YT	PXFRM	OTSAR1	SIMBW	4	SIMFØ	8	FOURIER TRANSFORM OF SINGLE PULSE OF
						FI	11	SPW	95	MULTIPLE PULSE BURST
						SIMFØ	8	NSUBP	96	Closed form solution
								BPRI	114	
RDFNCL	406	XT,YT	XT,YT	RDIGFL	ODFIN	-	-	FFØ	68	DIGITAL FILTER-REAL
								FF1	69	Storage registers not zeroed
								FB1	70	
								FB2	71	
RDIGFL	405	XT,YT	XT,YT	RDIGFL	ODFIN	-	-	FFØ	68	DIGITAL FILTER-REAL
								FF1	69	Storage registers zeroed
								FB1	70	
								FB2	71	
RECF	451	XT,YT	XT,YT	RECF	OTSAR1	-	-	FBCK	75	TSAR RECEIVER PROCESSOR
		XA,XB *		DFT	OMISC2			DX	77	
								NROWS	79	* XA and XB are used for temporary storage
								RECDEL	117	
								RECIRT	118	
								THETAR	119	
RECFTF	452	--	XT,YT	RECF	OTSAR1	-	-	FBCK	75	TSAR RECEIVER PROCESSOR TRANSFER FUNCTION
				DFT	OMISC2			DX	77	
								NROWS	79	
								RECDEL	117	
								RECIRT	118	
								THETAR	119	
RNDARY	214	--	XT	RNDARY	OSUP2	-	-	NRNDPT	44	LOADS ARRAY WITH RANDOM NUMBERS
								NTYPER	45	
RNDARY	215	--	YT	RNDARY	OSUP2	-	-	NRNDPT	44	LOADS ARRAY WITH RANDOM NUMBERS
								NTYPER	45	
RRAND	101	--	--	RRAND	OSUP1	-	-	IRND	22	EXECUTION OF MODULE NUMBER 101 INITIALIZES
								IADD1	23	THE RANDOM NUMBER GENERATOR
								JRND	24	
								UMEAN	25	
								UEXT	26	
								XMEAN	27	
								SIGMA	28	
								NRAND(1)	201	

MODULE		ARGUMENTS		SUBROUTINES & SYMREFS REQ'D		SYSTEM PARAMETERS		MODULE NAMELIST PARAMETERS		COMMENTS
NAME	#	INPUT	OUTPUT	NAME	PRMFL	NAME	LOC	NAME	LOC	
RRAND	102	--	--	RRAND	OSUP1	-	-	UMEAN UEXT XMEAN SIGMA	25 26 27 28	SAME AS 101 EXCEPT ONLY DISTRIBUTION PARAMETERS ARE INITIALIZED
RSHIFT	229	XT,YT	XT,YT	SHIFT	OMISC1	SIMFØ	8	SIMFØ SHTØ SHPHAS TJIT	8 180 181 182	WAVEFORM TIME SHIFT WITH JITTER
RSHIFT	230	XT,YT	XA,XB	SHIFT	OMISC1	SIMFØ	8	SIMFØ SHTØ SHPHAS TJIT	8 180 181 182	WAVEFORM TIME SHIFT WITH JITTER
RSHIFTS	231	XT,YT	XA,XB	SHIFT	OMISC1	SIMFØ	8	SIMFØ SHTØ SHPHAS TJIT	8 180 181 182	WAVEFORM TIME SHIFT WITH JITTER
RSHIFTS	232	XT,YT	XA,XB*	SHIFT	OMISC1	SIMFØ	8	SIMFØ SHTØ SHPHAS TJIT	8 180 181 182	WAVEFORM TIME SHIFT WITH JITTER * XA & XB are zeroed prior to execution
RTOPDB	103	XT,YT	XA,XB	RTOPDB	OSUP2	-	-	-	-	RECTANGULAR TO POLAR CONVERSION Modulus in dB
RTOPM	110	XT,YT	XA,XB	RTOPDB	OSUP2	-	-	-	-	RECTANGULAR TO POLAR CONVERSION Modulus in linear units
RTOPM2	111	XT,YT	XA,XB	RTOPDB	OSUP2	-	-	-	-	RECTANGULAR TO POLAR CONVERSION Modulus in squared units
SCANNR	313	XA	SYSOUT	SCANNR	OANT2	-	-	-	-	DATA SCANNER (determines main lobe and side lobe parameters)
SHIFT	224	XT,YT	XT,YT	SHIFT	OMISC1	SIMFØ	8	SIMFØ SHTØ SHPHAS	8 180 181	WAVEFORM TIME SHIFT
SHIFT	225	XT,YT	XA,XB	SHIFT	OMISC1	SIMFØ	8	SHTØ SHPHAS SIMFØ	180 181 8	WAVEFORM TIME SHIFT
SHIFTS	226	XT,YT	XA,XB	SHIFT	OMISC1	SIMFØ	8	SHTØ SHPHAS SIMFØ	180 181 8	WAVEFORM TIME SHIFT

MODULE		ARGUMENTS		SUBROUTINES & SYMREFS REQ'D		SYSTEM PARAMETERS		MODULE NAMELIST PARAMETERS		COMMENTS
NAME	#	INPUT	OUTPUT	NAME	PRMFL	NAME	LOC	NAME	LOC	
SHIFTS	227	XT,YT	XA,XB*	SHIFT	OMISC1	SIMFØ	8	SHØ SHPHAS SIMFØ	180 181 8	WAVEFORM TIME SHIFT * XA and XB are zeroed prior to execution
SPCAVG	312	XA	SYSOUT	SPCAVG	OANT2	-	-	-	-	ANTENNA OUTPUT INTEGRATED OVER ALL SPACE
SQDET	418	XT	XT	HWDET	OMISC2	-	-	-	-	SQUARE LAW DETECTOR
SQDET	419	YT	YT	HWDET	OMISC2	-	-	-	-	SQUARE LAW DETECTOR
SWPINT	434	XT	XT	SWPINT	ODIG	-	-	FBCK	75	SWEEP INTEGRATOR Delay line storage is zeroed
SWPINT	435	YT	YT	SWPINT	ODIG	-	-	FBCK	75	SWEEP INTEGRATOR Delay line storage is zeroed
(SYS)	301	--	--	MAIN1	DLODR	N2	1			EXECUTION OF MODULE NUMBER 301 INITIALIZES THE SYSTEM PARAMETER TABLE
				MAIN2	OSIMEX	FS	2			
						RFFØ	3			
				AZGAIN	OSUP2	SIMBW	4			
				ELGAIN	OSUP2	ISDUMP	5			
				ANTINT	OMISC2	ICINV	6			
						ICFOR	7			
				IPACK	OSUP1	SIMFØ	8			
				RRAND	OSUP1	NORMFT	9			
				B DATA	OSUP1	WSCAN	10			
				DBLKX	OSUP1	FI	11			
						TI	12			If FS is specified, TI will be computed
						LAMBDA	13			If RFFØ is specified, LAMBDA will be computed
						RNGCEL	14			
						TIME	16			
						ANTAZØ	18			
						ANTELØ	20			
						PRI(I)	130			
						NPRIS	142			
						IPRIPT	143			
						NREPET	144			
						AZBST	150			
						NPTAZ	151			
						ELBST	152			
						NPTEL	153			
						ANTAZ(I,J)	201			
						ANTEL(I,J)	351			
TARGET	501	--	XT,YT*	TARGET	OTGCL	RFFØ	3	RFFØ	3	TARGET MODEL TRANSFER FUNCTION * XT & YT zeroed before execution
						SIMBW	4	IDDUMP	21	
				AZGAIN	OSUP2	SIMFØ	8	HTGT	106	
				ELGAIN	OSUP2	FI	11	RTGT	107	
						TIME	16	ANGTGT	108	

MODULE		ARGUMENTS		SUBROUTINES & SYMREFS REQ'D		SYSTEM PARAMETERS		MODULE NAMELIST PARAMETERS		COMMENTS
NAME	#	INPUT	OUTPUT	NAME	PRMFL	NAME	LOC	NAME	LOC	
TARGET(cont.)								TORINT	109	
								RSIM	110	
								NSCAT	111	
								TGTVEL	112	
								TSCAT(I,J)	201	
TGTNCL	502	--	XT,YT	TARGET	OTGCL	RFFØ	3	RFFØ	3	TARGET MODEL TRANSFER FUNCTION
						SIMBW	4	IDDUMP	21	
						SIMFØ	8	HTGT	106	
						FI	11	RTGT	107	
						TIME	16	ANGTGT	108	
								TORINT	109	
								RSIM	110	
								NSCAT	111	
								TGTVEL	112	
								TSCAT(I,J)	201	
TSARY	426	--	XT,YT	TSARY	OTSAR	RFFØ	3	RFFØ	3	PHASED ARRAY ANTENNA TRANSFER FUNCTION -
			XA,XB *			SIMBW	4	IDDUMP	21	INITIAL EXECUTION
				DFT	OMISC2	SIMFØ	8	NTSAR	76	Wide bandwidth waveforms
						FI	11	DX	77	
								THETAS	78	* XA and XB are used for scratch storage
								NROWS	79	
								NBPSR	82	
								IRPSR	83	
								TDLINE	86	
								ANGLE	87	
								MODTSR	116	
								RECDEL	117	
								THETAR	119	
								TDLMON	185	
								TSRLOS(I)	401	
TSARY1	427	--	XT,YT	TSARY	OTSAR	RFFØ	3	RFFØ	3	PHASED ARRAY ANTENNA TRANSFER FUNCTION -
			XA,XB *			SIMBW	4	IDDUMP	21	SUBSEQUENT EXECUTIONS
				DFT	OMISC2	SIMFØ	8	NTSAR	76	Wide bandwidth waveforms
						FI	11	DX	77	
								THETAS	78	
								NROWS	79	
								NBPSR	82	* XA and XB are used for scratch storage
								IRPSR	83	
								TDLINE	86	
								ANGLE	87	
								MODTSR	116	
								RECDEL	117	
								THETAR	119	
								TDLMON	185	

MODULE		ARGUMENTS		SUBROUTINES & SYMREFS REQ'D		SYSTEM PARAMETERS		MODULE NAMELIST PARAMETERS		COMMENTS
NAME	#	INPUT	OUTPUT	NAME	PRMFL	NAME	LOC	NAME	LOC	
TSRPAT	505	XT,YT	XT,YT	TSRPAT	OTSAR	RFF0	3	ADELT	33	PHASED ARRAY FAR FIELD PATTERN GENERATION
			XA,XB *	TSARY	OTSAR	SIMBW	4	ASTRT	34	
				DFT	OMISC2	SIMF0	8	ASTOP	35	Wide bandwidth waveforms
				RECF	OTSAR1	FI	11	FBCK	75	
								NTSAR	76	* XA and XB are used for scratch storage
								DX	77	
								THETAS	78	
								NROWS	79	
								NBPSR	82	
								IRPSR	83	
								TDLINE	86	
								MODTSR	116	
								RECDEL	117	
								RECIRT	118	
								THETAR	119	
								TDLMON	185	
								TSRLOS(I)	401	
WEITCP	222	XT,YT	XT,YT	WEITRE	OMISC1	-	-	NPWT	37	WEIGHTING FUNCTION
								ORIG	38	Rectangular complex on
								WT(I,J)	201	rectangular complex
WEITMP	223	XT,YT	XT,YT	WEITRE	OMISC1	-	-	NPWT	37	WEIGHTING FUNCTION
								ORIG	38	Polar on Polar
								WT(I,J)	201	
WEITRE	221	XT,YT	XT,YT	WEITRE	OMISC1	-	-	NPWT	37	WEIGHTING FUNCTION
								ORIG	38	Real on rectangular complex
								WT(I,J)	201	
WVGUID	510	XT,YT	XT,YT	WVGUID	OTGCL	RFF0	3	CFREQ	146	TRANSFER FUNCTION OF
								XWLENG	147	PERFECTLY CONDUCTING WAVEGUIDE
XYTODB	104	XT,YT	XA	RTOPDB	OSUP2	-	-	-	-	RECTANGULAR TO MAGNITUDE CONVERSION
										Output in dB
XYTODB	108	XT,YT	XT	RTOPDB	OSUP2	-	-	-	-	RECTANGULAR TO MAGNITUDE CONVERSION
										Output in dB
XYTOM	105	XT,YT	XA	RTOPDB	OSUP2	-	-	-	-	RECTANGULAR TO MAGNITUDE CONVERSION
										Output in linear units
XYTOM2	106	XT,YT	XA	RTOPDB	OSUP2	-	-	-	-	RECTANGULAR TO MAGNITUDE CONVERSION
										Output in squared units

MODULE		ARGUMENTS		SUBROUTINES & SYMREFS REQ'D		SYSTEM PARAMETERS		MODULE NAMELIST PARAMETERS		COMMENTS
NAME	#	INPUT	OUTPUT	NAME	FRMFL	NAME	LOC	NAME	LOC	
ZFFT	292	XT,YT	XT,YT	ZFFT	OZFFT	N2	1	N2	1	FAST FOURIER TRANSFORM
						SIMBW	4	SIMBW	4	
						ICINV	6	ICINV	6	
						ICFOR	7	ICFOR	7	
						NORMFT	9	NORMFT	9	
								FSHIFT	15	
ZIFFT	293	XT,YT	XT,YT	ZFFT	OZFFT	N2	1	N2	1	INVERSE FOURIER TRANSFORM
						SIMBW	4	SIMBW	4	
						ICINV	6	ICINV	4	
						ICFOR	7	ICFOR	7	
						NORMFT	9	NORMFT	9	
								FSHIFT	15	
						A D D E N D A				
(BISTAT -SYS)	311	--	--	MAIN2	OSIMEX	WSCANB	17	-		Bistatic Antenna Initialization
						BASLIN	19			
						ANBAZØ	150			
						ANBELØ	151			
						NPTAZ	321			
						AZBST	322			
						NPTCL	323			
						ELBST	324			
						ANTAZ	331			
						ANTEL	481			
CHAFF	514	--	XT,YT	CHAFF	OCHAFF	RFFØ	3	NDIPOL	212	Chaff Model
						FEXT	4	CHFRNG	213	XT,YT cleared prior to execution
						FI	11	CHFHGT	214	
								CHFAZ	215	
								DORINT (I,J)	321	
								DIPLNG	219	
								DIPDIA	220	

MODULE		ARGUMENTS		SUBROUTINES & SYMREFS REQ'D		SYSTEM PARAMETERS		MODULE NAMELIST PARAMETERS		COMMENTS
NAME	#	INPUT	OUTPUT	NAME	PRMFL	NAME	LOC	NAME	LOC	
CHAFF	515	XT,YT	XT,YT	CHAFF	OCHAFF*	RFFØ	3	NDIPOL	212	Chaff Model
						FEXT	4	CHFRNG	213	Transfer functions summed into XT,YT
						FI	11	CHFHGT	214	
								CHFAZ	215	
								DORINT (I,J)	321	
								DIPLNG	219	
								DIPDIA	220	
DIPOLE	464	--	XT,YT	DIPOLE	OCHAFF*	RFFØ	3	THETAD	216	Thin wire dipole scatterer
						FEXT	4	RHOD	217	XT,YT cleared prior to execution
						FI	11	TSHFTD	218	
								DIPLNG	219	
								DIPDIA	220	
DIPOLE	465	XT,YT	XT,YT	DIPOLE	OCHAFF*	RFFØ	3	THETAD	216	Thin wire dipole scatterer
						FEXT	4	RHOD	217	Transfer function summed into XT,YT
						FI	11	TSHFTD	218	
								DIPLNG	219	
								DIPDIA	220	
SCYL	513	XT,YT	XT,YT	SCYL	OCYL*	RFFØ	3	HTGT	106	Target model - right circular cylinder
						BASLIN	19	RTGT	107	
								ANGTGT	108	
								TORINT	109	
								RSIM	110	
								ACYL	201	
								HCYL	202	
								IPOL	205	

* These modules are located in BECAVUØ1 and the SELECT cards must be of the form:

$:SELECT:BECAVUØ1/RCSM$JR/——

B.2 SOFTWARE MODULES LISTED BY REFERENCE NUMBER

This table includes all of the software modules listed in numerical order by module reference number.

100 SERIES: Basic transfer and input/output operations

200 SERIES: Basic mathematical operations

300 SERIES: Initialization and output configuration routines

400 SERIES: Radar block simulation modules (black box models)

500 SERIES: Radar system modules (radar system models)

Table B.2-1a 100 SERIES MODULES

101	RRAND	Parameter Initialization
102	RRAND	Parameter Initialization
103	RTOPDB	
104	XYTODB	
105	XYTOM	
106	XYTOM2	
108	XYTODB	
110	RTOPM	
111	RTOPM2	
113	PLTFMT	
114	(DATA XFER)	
115	(DATA XFER)	
116	ERGYRE	
117	ERGYRE	
118	ERGYCP	

Table B.2-1b 200 SERIES MODULES

201	DFT
202	ZFFT
203	ZIFFT
204	CONV
205	CONVMP
206	DIVA
207	ADDA
208	CUMDIS
209	CUMDIS
210	OUTCUM
211	OUTCUM
212	PDF
213	PDF
214	RNDARY
215	RNDARY
216	ATOD
217	ATOD
218	DTOA
219	DTOA
220	DTOA
221	WEITRE
222	WEITCP
223	WEITMP
224	SHIFT
225	SHIFT
226	SHIFTS
227	SHIFTS
228	DTOA
229	RSHIFT
230	RSHIFT
231	RSHFTS
232	RSHFTS
233	DFTRF
234	DFTFØ
235	ADDRND
236	ADDRND
237	ADRNDC
239	ADDA

Table B.2-1c 300 SERIES MODULES

301	(SYSTEM)
302	CLINT
303	PTLIST
304	PTLIST
305	PTLIST
306	PTLIST
307	PLOTTR
308	PLOTTR
309	PLOTTR
310	PLOTTR
311	(BISTATIC ANTENNA INITIALIZATION)
312	SPCAVG
313	SCANNR

Table B.2-1d 400 SERIES MODULES

401	NONLIN	438	HLIM
402	NONLIN	439	HLIM
403	CDIGFL	440	DCFAR
404	CDFNCL	441	DCFAR
405	RDIGFL	442	IHLIM
406	RDFNCL	443	IHLIM
407/408	FILT	445	IHWDET
409	INGTOR	446	IHWDET
410	INGTOR	447	IFWDET
413	ANTARY	448	IFWDET
414	HWDET	449	ISQDET
415	HWDET	450	ISQDET
416	FWDET	451	RECF
417	FWDET	452	RECFTF
418	SQDET	453	CGENSF
419	SQDET	454	PXFRM
420	FGENXY	455	CGENCW
421	FGENMP	456	LAMPRE
422	DIGTFL	457	LAMPRE
423	DIGTFL	458	LAMPCP
425	CGEN	459	CFAR
426	TSARY	460	CFAR
427	TSARY1	461	DIGFIL
430	MTIFLT	462	DIGFNC
431	MTIFLT	463	DIGFSF
432	MTINCL	464	DIPOLE
433	MTINCL	465	DIPOLE
434	SWPINT		
435	SWPINT		
436	NCSWPI		
437	NCSWPI		

Table B.2-1e 500 SERIES MODULES

501	TARGET
502	TGTNCL
503	CLUTTR
504	ANTPAT
505	TSRPAT
506	PHENC
507	PHENC
508	PHDEC
509	PHDEC
510	WVGUID
511	IONOS
512	ECM
513	SCYL
514	CHAFF
515	CHAFF

APPENDIX C

VARIABLES USED IN THE RADAR SIMULATION MODEL

This list includes all the system and module parameters used in the modules in Appendix B. Column headings in the list are defined as follows:

1. NAME: Name of variable used in the system model program.

2. SYMBOL: Symbol of variable used in text.

3. UNITS: Dimensions of variable used in module program.

4. LOC: Location of variable in module program.

5. MODULE NUMBER and NAME: Modules that use variable.

6. NAME IN MODULE: Name of variable used in the module program.

7. COMMENTS: Short description, restrictions, and default value.

Note that the variable names in column 1 are the system variable names, which are referred to in Volume 1. The variable names in column 6 are the module or subroutine variable names, which are referred to in Volume 2. Table C-2 lists in alphabetical order those module names which are different from their corresponding system names.

Table C-1 VARIABLES USED IN THE RADAR SIMULATION MODEL

VARIABLE NAME (SYSTEM)	SYMBOL	UNITS	LOC	MODULE NUMBER	MODULE NAME	VARIABLE NAME (MODULE)	COMMENTS
ADCFS	f_{ADC}	GHz	149	216 217	ATOD ATOD	ADCFS ADCFS	A-TO-D converter sampling rate (Default = FS)
ADELT	$\Delta\theta$	Degrees	33	113 505	PLTFMT TSRPAT	DELTHE ADELT	Angle increment
ANGLE	θ	Degrees	87	426 427 505*	TSARY TSARY1 TSRPAT	ANGLE ANGLE ANGLE	Angle of TSAR response evaluation
ANGTGT	ψ_T	Degrees	108	501 502	TARGET TGTNCL	ANGTGT ANGTGT	Target azimuth angle with respect to radar
ANTAZ(1,J) ANTAZ(2,J) J=1,NPTAZ	$G_\psi(J)$ $\psi(J)$	Magnitude Degrees	201	301	(SYS) ANTINT	ANTAZ(2,75) ANTP(2,75)	Sampled antenna azimuth gain pattern (Power Units)
ANTAZØ	ψ_o	Degrees	18	301	(SYS)	ANTAZØ	Initial antenna azimuth angle
ANTEL(1,J) ANTEL(2,J) J=1,NPTEL	$G_\varepsilon(J)$ $\varepsilon(J)$	Magnitude Degrees	351	301	(SYS) ANTINT	ANTEL(2,75) ANTP(2,75)	Sampled antenna elevation gain pattern (normalized)
ANTELØ	ε_o	Degrees	20	301	(SYS)	ANTELØ	Initial antenna elevation angle
ASTOP	—	Degrees	35	113 505	PLTFMT TSRPAT	STOPT ASTOP	Stop angle
ASTRT	—	Degrees	34	113 505	PLTFMT TSRPAT	STARPT ASTRT	Start angle
AZANG	ψ	Degrees	17	FUNCTION	AZGAIN	ANTANG	Antenna azimuth angle
AZBST	ψ_{BS}	Degrees	150	301	(SYS) ANTINT	AZBST BSIT	Antenna azimuth boresight with respect to gain pattern
AZEXT	—	Degrees	53	302	CLINT	AZEXT	Clutter volume azimuth extent
AZØ	—	Degrees	54 (9)	302 503*	CLINT CLUTTR	AZØØØ AZØØØ	Clutter volume initial azimuth angle
BLIM	—		40	208 209	CUMDIS CUMDIS	BLIM BLIM	Lower bound of histogram
BPRI	T_B	Ns	114	453* 454 455*	CGENSF PXFRM CGENCW	BPRI BPRI BPRI	Burst pulse repetition interval
CFREQ	f_c	GHz	146	510	WVGUID	CFREQ	Cutoff Frequency of Waveguide

VARIABLE NAME (SYSTEM)	SYMBOL	UNITS	LOC	MODULE NUMBER	MODULE NAME	VARIABLE NAME (MODULE)	COMMENTS
CHIRP	μ	GHz/Ns	92	420	FGENXY	CHIRP	The rate of frequency change
				421	FGENMP	CHIRP	(User specified only if NPWTX ≠ 0 or
				425*	CGEN	CHIRP	NSUBP ≠ 0 ; otherwise CHIRP = FMBW/PW)
				506	PHENC/FGENXY	CHIRP	
				507	PHENC/FGENMP	CHIRP	
DELAZ	$\Delta\psi$	Degrees	123	302*	CLINT	DELAZ	Azimuth spacing of clutter scatterers
			(17)	503*	CLUTTR	DELAZ	
DELEL	$\Delta\varepsilon$	Degrees	124	302*	CLINT	DELEL	Elevation spacing of clutter scatterers
			(18)	503*	CLUTTR	DELEL	
DFTIN(1,J)	$\phi(J)$	Degrees	201	201	DFT	DIN(3,100)	DFT input samples to be transformed
DFTIN(2,J)	$t(J)$	Ns		233	DFTRF	DIN(3,100)	
DFTIN(3,J)	$a(J)$	Magnitude		234	DFTFØ	DIN(3,100)	
J=1,NIMP				426*	TSARY	DIN(3,100)	
				427*	TSARY1	DIN(2,100)	
				451*	RECF	DIN(3,100)	
				452*	RECFTF	DIN(3,100)	
				508*	PHDEC	DIN(3,100)	
				509*	PHDEC	DIN(3,100)	
DOPFRQ	$f_{d\omega}$	Hz*	127	302*	CLINT	DOPFRQ	Doppler frequency shift of clutter
			(21)	503*	CLUTTR	DOPFRQ	induced by wind. *Always in Hz.
DX	d	Meters	77	413	ANTARY	DX	Antenna element spacing
				425	CGEN	DX	
				426	TSARY	DX	
				427	TSARY1	DX	
				451	RECF	DX	
				452	RECFTF	DX	
				453	CGENSF	DX	
				455	CGENCW	DX	
				504	ANTPAT	DX	
				505	TSRPAT	DX	
ELANG	ε	Degrees	19	FUNCTION	ELGAIN	ANTANG	Antenna elevation angle
ELBST	ε_{BS}	Degrees	152	301	(SYS)	ELBST	Antenna elevation boresight
					ANTINT	BSIT	with respect to gain pattern
ELEXT	—	Degrees	56	302	CLINT	ELEXT	Clutter volume elevation extent
ELØ	—	Degrees	57	302	CLINT	ELØØØ	Clutter volume initial
			(12)	503*	CLUTTR	ELØØØ	elevation angle

VARIABLE NAME (SYSTEM)	SYMBOL	UNITS	LOC	MODULE NUMBER	MODULE NAME	VARIABLE NAME (MODULE)	COMMENTS
FALTIM	t_f	Ns	99	420	FGENXY	FALTIM	Pulse fall time
				421	FGENMP	FALTIM	(Default = TI)
				425	CGEN	FALTIM	
				506	PHENC/FGENXY	FALTIM	
				507	PHENC/FGENMP	FALTIM	
FBCK	-	Gain	75	409	INGTOR	FBCK	Integration feedback constant
				410	INGTOR	FBCK	
				434	SWPINT	FBCK	
				435	SWPINT	FBCK	
				436	NCSWPI	FBCK	
				437	NCSWPI	FBCK	
				451	RECF	FBCK	
				452	RECFTF	FBCK	
				505	TSRPAT	--	
FBCOEF(1,J)	-	1 Delay Gain	201	461	DIGFIL	FB(2,25)	Feedback coefficients for
FBCOEF(2,J)	-	2 Delay Gain		462	DIGFNC	FB(2,25)	recursive disital filter
J=1,NSEC							
FBI	-	Gain	71	403	CDIGFL	FBXY	Imaginary component of
				404	CDFNCL	FBXY	feedback coefficient
FBR	-	Gain	70	403	CDIGFL	FBX	Real component of feedback coefficient
				404	CDFNCL	FBX	
FB1	-	Gain	70	405	RDIGFL	FB1	One delay feedback coefficient
				406	RDFNCL	FB1	
				430	MTIFLT	FB1	
				431	MTIFLT	FB1	
				432	MTINCL	FB1	
				433	MTINCL	FB1	
FB2	-	Gain	71	405	RDIGFL	FB2	Two delay feedback coefficient
				406	RDFNCL	FB2	
				430	MTIFLT	FB2	
				431	MTIFLT	FB2	
				432	MTINCL	FB2	
				433	MTINCL	FB2	
FFCOEF(1,J)	-	0 Delay Gain	251	461	DIGFIL	FF(2,25)	Feed forward coefficients for
FFCOEF(2,J)	-	1 Delay Gain		462	DIGFNC	FF(2,25)	recursive disital filter
J=1,NSEC							
FFI		Gain	69	403	CDIGFL	FFXY	Imaginary component of
				404	CDFNCL	FFXY	feed forward coefficient
FFR	-	Gain	68	403	CDIGFL	FFX	Real compoent of feed
				404	CDFNCL	FFX	forward coefficient

VARIABLE NAME (SYSTEM)	SYMBOL	UNITS	LOC	MODULE NUMBER	MODULE NAME	VARIABLE NAME (MODULE)	COMMENTS
FFØ	–	Gain	68	405	RDIGFL	FFØ	Zero delay feed forward coefficient
				406	RDFNCL	FFØ	
				430	MTIFLT	FFØ	
				431	MTIFLT	FFØ	
				432	MTINCL	FFØ	
				433	MTINCL	FFØ	
FF1	–	Gain	69	405	RDIGFL	FF1	One delay feed forward coefficient
				406	RDFNCL	FF1	
				430	MTIFLT	FF1	
				431	MTIFLT	FF1	
				432	MTINCL	FF1	
				433	MTINCL	FF1	
FI	Δf	GHz	11	201+	DFT	FI	Frequency sampling increment
				233+	DFTRF	FI	
				234+	DFTFØ	FI	
				301	(SYS)	FI	
				426+	TSARY	FI	
				427+	TSARY1	FI	
				454+	PXFRM	FI	
				501+	TARGET	FI	
				502+	TGTNCL	FI	
				505+	TSRPAT	FI	
FMBW	B_{fm}	GHz	93	420	FGENXY	FMBW	Frequency modulation bandwidth
				421	FGENMP	FMBW	
				425	CGEN	FMBW	
FPOLE(1,J) FPOLE(2,J) J=1,NP	$\sigma_p(J)$ $f_p(J)$	Real-GHz Imag-GHz	301	407 408	FILT FILT	FPOLE(2,50) FPOLE(2,50)	S-Plane filter specification pole location(s)
FS	f_s	GHz	2	301	(SYS)	FS	Time domain sampling rate IF (FS = 0.0 AND TI ≠ 0.0) FS = 1.0/TI
				420+	FGENXY	FS	
				421+	FGENMP	FS	
				506+	PHENC/FGENXY	FS	
				507+	PHENC/FGENMP	FS	
				503+	CLUTTR	FS	
FSAM(1,J) FSAM(2,J) J=1,NSAM	– –	Real Gain Imag Gain	201	463 512	DIGFSF ECM	FSAM(2,100) --	Equi-spaced samples of filter transfer function
FSHIFT	f_{het}	GHz	15	202	ZFFT	FSHIFT	Frequency shift
				203	ZIFFT	FSHIFT	
FSTRT	f_{st}	GHz	91	420	FGENXY	FSTART	Starting frequency (User specified only if NPWIX ≠ 0 or NSUBP ≠ 0 and CHIRP ≠ 0.0)
				421	FGENMP	FSTART	
				425*	CGEN	FØXMT	

VARIABLE NAME (SYSTEM)	SYMBOL	UNITS	LOC	MODULE NUMBER	MODULE NAME	VARIABLE NAME (MODULE)	COMMENTS
FSTRT(cont.)				506	PHENC/FGENXY	FSTART	
				507	PHENC/FGENMP	FSTART	
FZERO(1,J) FZERO(2,J) J=1,NZ	$\sigma_z(J)$ $f_z(J)$	Real-GHz Imag-GHz	201	407 408	FILT FILT	FZERO(2,50) FZERO(2,50)	S-Plane filter specification zero location(s)
FØDEC		GHz	102	508 509	PHDEC PHDEC	FØDEC FØDEC	Phase decoder center frequency (User specified only if INPTF = 1 ; otherwise set equal to SIMF0)
GAIN	g	**Volts(out)/ Volts(in)**	145	456 457 458	LAMPRE LAMPRE LAMPCP	GAIN GAIN GAIN	**Linear Amplifier Voltage Gain**
GLBL(J) J=1,18	-	-	301	307 308 309 310	PLOTTR PLOTTR PLOTTR PLOTTR	GLBL(18) GLBL(18) GLBL(18) GLBL(18)	Plot label
HTGT	H_T	Meters	106	501 502	TARGET TGTNCL	HTGT HTGT	Height of target
IADD1			23	101	RRAND	MAD1	Random number generator starting address (Default = 1)
ICFLG	-	-	126 (20)	302* 503*	CLINT CLUTTR	ICFLG ICFLG	Clutter data flag ICFLG = 0; Clutter model parameters not initialized 1; Clutter model parameters initialized
ICFOR	-	-	7	202 301	ZFFT (SYS)	ICPLXF ICFOR	Fourier transform complex data flag (Default = 1) ICFOR = 0; Real signal data 1; Complex signal data
ICINV	-	-	6	203 301	ZIFFT (SYS)	ICPLXI ICINV	Inverse Fourier transform complex data flag (Default = 1) ICINV = 0; Real signal data 1; Complex signal data
ICODE	-	-	194	506 507	PHENC PHENC	CODE CODE	User specified phase code (MODEPH = 3)
IDDUMP	-	-	21	101 102 201 233	RRAND RRAND DFT DFTRF	IDMY1 IDMY1 IDMP IDMP	Data dump flag IDDUMP = 0;Suppress data dump 1;Dump diagnostic data from modules

VARIABLE NAME (SYSTEM)	SYMBOL	UNITS	LOC	MODULE NUMBER	MODULE NAME	VARIABLE NAME (MODULE)	COMMENTS
IDDUMP(cont.)				234	DFTFØ	IDMP	
				302	CLINT	IDMP	
				413	ANTARY	IDMY	
				425	CGEN	IDMP	
				426	TSARY	IDMY	
				427	TSARY1	IDMY	
				501	TARGET	IDMY	
				502	TGTNCL	IDMY	
				503*	CLUTTR	IDMP	
				504	ANTPAT	IDMY	
				505	TSRPAT	IDMY	
IFB1D	-	Gain	165	430	MTIFLT	IFB1D	One delay integer feedback coefficient - denominator (Default = 1)
				431	MTIFLT	IFB1D	
				432	MTINCL	IFB1D	
				433	MTINCL	IFB1D	
IFB1N	-	Gain	164	430	MTIFLT	IFB1N	One delay integer feedback coefficient - numerator
				431	MTIFLT	IFB1N	
				432	MTINCL	IFB1N	
				433	MTINCL	IFB1N	
IFB2D	-	Gain	167	430	MTIFLT	IFB2D	Two delay integer feedback coefficient - denominator (Default = 1)
				431	MTIFLT	IFB2D	
				432	MTINCL	IFB2D	
				433	MTINCL	IFB2D	
IFB2N	-	Gain	166	430	MTIFLT	IFB2N	Two delay integer feedback coefficient - numerator
				431	MTIFLT	IFB2N	
				432	MTINCL	IFB2N	
				433	MTINCL	IFB2N	
IFCODE	-	-	113	303	PTLIST	IFCODE	Output data file code
				304	PTLIST	IFCODE	
				305	PTLIST	IFCODE	
				306	PTLIST	IFCODE	
				307	PLOTTR	IC	
				308	PLOTTR	IC	
				309	PLOTTR	IC	
				310	PLOTTR	IC	
IFFØD	-	Gain	161	430	MTIFLT	IFFØD	Zero delay integer feed forward coefficient - denominator (Default = 1)
				431	MTIFLT	IFFØD	
				432	MTINCL	IFFØD	
				433	MTINCL	IFFØD	
IFFØN	-	Gain	160	430	MTIFLT	IFFØN	Zero delay integer feed forward coefficient - numerator
				431	MTIFLT	IFFØN	
				432	MTINCL	IFFØN	
				433	MTINCL	IFFØN	

VARIABLE NAME (SYSTEM)	SYMBOL	UNITS	LOC	MODULE NUMBER	MODULE NAME	VARIABLE NAME (MODULE)	COMMENTS
IFF1D	-	Gain	163	430 431 432 433	MTIFLT MTIFLT MTINCL MTINCL	IFF1D IFF1D IFF1D IFF1D	One delay integer feed forward coefficient - demoninator (Default = 1)
IFF1N	-	Gain	162	430 431 432 433	MTIFLT MTIFLT MTINCL MTINCL	IFF1N IFF1N IFF1N IFF1N	One delay integer feed forward coefficient - numerator
INORM	-	-	84	413 504	ANTARY ANTPAT	INORM INORM	Antenna gain normalization flag
INPTF	-	-	155	508 509	PHDEC PHDEC	INPTF INPTF	Flag to indicate user provided inputs are available
IPY(J) J=1,NSR	-	-	186	506 507	PHENC PHENC	IPY(8) IPY(8)	Shift register initial values
IPRIPT	-	-	143	301	(SYS)	IPRIPT	Pulse repetition interval pointer (Default = 1 ; 1 ≤ IPRIPT ≤ NPRIS ≤ 11)
IRND	-	-	22	101	RRAND	IRND	Random number generator variable
IROFF	-	-	105	216 217	ATOD ATOD	IROFF IROFF	A-to-D converter round off flag IROFF= 0;No roundoff 1;Roundoff used
IRPSCG	-	-	81	413 425 504	ANTARY CGEN ANTPAT	IRPSCG IRPSCG IRPSCG	Control generator phase shifter round off flag IRPSCG= 0; No Roundoff 1; Roundoff Used
IRPSR	-	-	83	413 426 427 504 505	ANTARY TSARY TSARY1 ANTPAT TSRPAT	IRPSR IRPSR IRPSR IRPSR --	Antenna feed network phase shifter round off flag IRPSR= 0; No Roundoff 1; Roundoff Used
ISDUMP	-	-	5	301	(SYS)	ISDUMP	System data dump flag ISDUMP= 0; Only first EXEC block printed 1; EXEC Blocks Printed 2; EXEC & DATA Blocks Printed 3; DATA Blocks Printed

VARIABLE NAME (SYSTEM)	SYMBOL	UNITS	LOC	MODULE NUMBER	MODULE NAME	VARIABLE NAME (MODULE)	COMMENTS
ITAP(1,J) ITAP(2,J) ITAP(3,J) J=1,NTAPS	$g_N(J)$ $g_D(J)$ $I_s(J)$	Gain Numerator Gain Demoninator Time Increments	201	422 423	DIGTFL DIGTFL	ITAP(3,100) ITAP(3,100)	Digital transversal filter tap specifications
JERP	P_J	Watts	175	512	ECM	JERP	Jammer Effective Radiated Power
JFMBW	B_J	GHz	176	512	ECM	JFMBW	Jammer swept Bandwidth
JFØ	f_{oJ}	GHz	178	512	ECM	JFØ	Jammer center frequency with respect to SIMFØ
JHGT	H_J	Meters	174	512	ECM	JHGT	Jammer height
JMAZ	ψ_J	Degrees	173	512	ECM	JMAZ	Jammer azimuth angle
JPEROD	T_J	Ns	157	512	ECM	JPEROD	Noise burst repetition interval
JPW	τ_J	Ns	177	512	ECM	JPW	Length of noise burst
JRND	-	-	24	101	RRAND	JRND	Random number generator variable
JRNG	R_J	Meters	171	512	ECM	JRNGØ	Jammer range at TIME = 0.0
JRSIM	R_J^*	Meters	172	512	ECM	JRSIM	Jammer range in simulation for TIME = 0.0 (used to compute time delay only)
JVEL	v_J	Meters/sec	156	512	ECM	JVEL	Jammer radial velocity
KCELL	-	Samples	128 (22)	302* 503*	CLINT CLUTTR	KCELL KCELL	Number of impulses which represent clutter as a function of range
KK	-	Cells	120 (14)	302* 503*	CLINT CLUTTR	KK KK	Number of clutter volume range increments
LAMBDA	λ	Meters	13	301+ 302+	(SYS) CLINT	LAMBDA LAMBDA	Wavelength IF(RFFØ ≠ 0.0) LAMBDA = 1.0/RFFØ
LF	-	-	62	303 304 305 306	PTLIST PTLIST PTLIST PTLIST	LF LF LF LF	Data type flag LF= 0;Magnitude scaling 1;Decibel scaling 2;Dependent variable is converted to log10 before plotting 3;Dependent variable is converted to dB before plotting, i.e. 10*log10 DV(J)

VARIABLE NAME (SYSTEM)	SYMBOL	UNITS	LOC	MODULE NUMBER	MODULE NAME	VARIABLE NAME (MODULE)	COMMENTS
MM	-	Cells	55 (10)	302 503#	CLINT CLUTTR	MM MM	Number of clutter volume azimuth increments
MODE	-	-	122 (16)	302# 503#	CLINT CLUTTR	MODE MODE	Clutter model mode flag MODE= 1$Clutter scatterers fixed during simulation 2$Scatterers phases vary as function of time
MODEDF	-	-	168	430 431 432 433	MTIFLT MTIFLT MTINCL MTINCL	-- -- -- --	Digital filter mode flag MODEDF= 1$Floating point arithmetic 2$Integer arithmetic
MODEPH	-	-	183	506 507	PHENC PHENC	MODEPH MODEPH	Phase encoder mode flag MODEPH= 1$Stored barker code 2$Pseudo-random code 3$User specified code
MODTSR	-	-	116	426 427 505	TSARY TSARY1 TSRPAT	MODTSR MODTSR MODTSR	TSAR mode flag MODTSR= 1$Transmit pencil beam 2$Receive pencil beam 3$Transmit pencil & receive pencil, (THETAR =THETAS, ARYDEL = RECDEL) 4$Transmit pencil & receive pencil, (THETAR ≠ THETAS, ARYDEL = RECDEL) 5$Transmit pencil & receive pencil, (THETAR ≠ THETAS, ARYDEL ≠ RECDEL) 6$Transmit pencil & receive monopulse 7$Receive monopulse
NAUTO	-	-	64	303 304 305 306	PTLIST PTLIST PTLIST PTLIST	NAUTO NAUTO NAUTO NAUTO	Data processing flag NAUTO= 0$the input data scanned to de- termine Max(TH)and Min(TL) value of the dependent variable 1$the user provided values of TH and TL used.
NBITDF	-	Bits	169	430 431 432 433	MTIFLT MTIFLT MTINCL MTINCL	NBITS NBITS NBITS NBITS	Digital filter data word size (Default = 31 Bits)
NBITS	-	Bits	104	216 217	ATOD ATOD	NBITS NBITS	A-to-D converter output word size (Includes sign Bit) (Default = 31 Bits)

VARIABLE NAME (SYSTEM)	SYMBOL	UNITS	LOC	MODULE NUMBER	MODULE NAME	VARIABLE NAME (MODULE)	COMMENTS
NBLKS	-	Records Of Random Disc File	121	302*	CLINT	NBLKS	Number of records occupied by clutter scatterer data
NBPSCG	-	Bits	80	413	ANTARY	NBPSCG	Accuracy of TSAR control
				425	CGEN	NBPSCG	generator phase shifter
				504	ANTPAT	NBPSCG	(Default = 15 Bits)
NBPSR	-	Bits	82	413	ANTARY	NBPSR	Accuracy of TSAR antenna
				426	TSARY	NBPSR	feed network phase shifters
				427	TSARY1	NBPSR	(Default = 15 Bits)
				504	ANTPAT	NBPSR	
				505	TSRPAT	--	
NCELL	-	Range Bins	170	440	DCFAR	NCELL	Number of range samples to be averaged
				441	DCFAR	NCELL	
NCGPLS	-	Pulses	88	425	CGEN	NSUBP	Number of TSAR control
				453	CGENSF	NCGPLS	generator subpulses
NCPACK	-	-	42	210	OUTCUM	NCPACK	Number of histogram samples
				211	OUTCUM	NCPACK	combined to generate each cumulative distribution sample (Default = 1)
NDFZ	-	-	197	463	DIGFSF	NDFZ	Number of zeros to be synthesied
				512	ECM	NDFZ	by comb filter (NDFZ ≤ 256)
NDPACK	-	-	43	212	PDF	NDPACK	Number of histogram samples
				213	PDF	NDPACK	combined to generate each probability density sample (Default = 1)
NHIST	-	Intervals	41	208	CUMDIS	NIXF	Number of histogram intervals
				209	CUMDIS	NIXF	(NHIST ≤ 8192)
NIMP	-	Samples	200	201	DFT	NIMP	Number of input samples to
				233	DFTRF	NIMP	be processed by DFT
				234	DFTFØ	NIMP	(NIMP ≤ 100)
				425*	CGEN	NPT	
				426*	TSARY	NIMP	
				427*	TSARY1	NIMP	
				451*	RECF	NPULS	
				452	RECFTF	NPULS	
				508*	PHDEC	NIMP	
				509*	PHDEC	NIMP	
NN	-	Cells	58 (13)	320	CLINT	NN	Number of clutter volume
				503*	CLUTTR	NN	elevation increments

VARIABLE NAME (SYSTEM)	SYMBOL	UNITS	LOC	MODULE NUMBER	MODULE NAME	VARIABLE NAME (MODULE)	COMMENTS
NORMFT	-	-	9	201+	DFT	INORM	Normalization flag
				202	ZFFT	INORM	NORMFT =
				203	ZIFFT	INORM	0;ZFFT and DFT by TI and
				233+	DFTRF	INORM	ZIFFT by FI
				234+	DFTFØ	INORM	1;ZFFT and DFT normalized
				301	(SYS)	NORMFT	by 1/ (number of input samples)
				425*	CGEN	INORM	2;ZIFFT normalized by 1/(2**N2)
				426*	TSARY	INORM	3;Normalizations 1 and 2 combined
				427*	TSARY1	INORM	4;No normalization
				451*	RECF	INORM	
				452*	RECFTF	INORM	
				420+	FGENXY	INORM	IF(NORMFT = 1 or 3) FGENXY(MP) output waveform
				421+	FGENMP	INORM	contains no leading or trailing zeros
				506+	PHENC/FGENXY	INORM	
				507+	PHENC/FGENMP	INORM	
				508+	PHDEC	--	
				509+	PHDEC	--	
NP	N_p	Poles	73	407	FILT	NP	Number of poles used in
				408	FILT	NP	specifying a filter (NP ≤ 50)
NPRIS	-	Intervals	142	301	(SYS)	NPRIS	Number of pulse repetition (NPRIS ≤ 11)
NPTAZ	-	Points	151	302	(SYS)	NPTAZ	Number of points in antenna
					ANTINT	NPT	azimuth pattern (NPTAZ ≤ 75)
NPTEL	-	Points	153	301	(SYS)	NPTEL	Number of points in antenna
					ANTINT	NPT	elevation pattern (NPTEL ≤ 75)
NPULS	-	Start Pulse	85	413	ANTARY	NPULS	Oldest pulse in TSAR sub-
				504	ANTPAT	NPULS	arrays/feed network
NPWT	-	Points	37	221	WEITRE	NPWT	Number of points in array
				222	WEITCP	NPWT	defining weighting function
				223	WEITMP	NPWT	(NPWT ≤ 100)
NPWTX	-	Points	94	420	FGENXY	NPWT	Number of points in array
				421	FGENMP	NPWT	defining transmitted pulse shape
				425	CGEN	NPWT	(NPWTX ≤ 100)
NRAND(J) J=1,129	-	-	201	101	RRAND	NRAND(129)	Array of random numbers (Default-array in BLOCK DATA Subprogram)
NRCS	-	-	46	302	CLINT	NRCS	Scatterer radar cross sec- tion probability distribu- tion flag (see NTYPER)
NREPET	-	Repetitions	144	301	(SYS)	NREPET	Number of times a configuration is to be repeated

VARIABLE NAME (SYSTEM)	SYMBOL	UNITS	LOC	MODULE NUMBER	MODULE NAME	VARIABLE NAME (MODULE)	COMMENTS
NRNDPT	-	Points	44	214 214	RNDARY RNDARY	NPTS NPTS	Number of random process samples to be generated (NRNDPT ≤ 8192)
NROWS	-	Rows	79	413 425 426 427 451 452 453 455 504 505	ANTARY CGEN TSARY TSARY1 RECF RECFTF CGENSF CGENCW ANTPAT TSRPAT	NROWS NROWS NROWS NROWS NROWS NROWS NROWS NROWS NROWS --	Number of interleaved TSAR subarrays
NSAM	-	Samples	196	463 512	DIGFSF ECM	NSAM --	Number of filter transfer function samples (NSAM ≤ 100)
NSCAT	-	Scatterers	111	501 502	TARGET TGTNCL	NSCAT NSCAT	Number of discrete scatterers used to represent a target (NSCAT ≤ 100)
NSEC	-	Filter Sections	199	461 462	DIGFIL DIGFNC	NP NP	Number of double delay (2-pole/2-zero) filter sections in digital filter (NSEC ≤ 25)
NSKP	-	Points	63	303 304 305 306 307 308 309 310	PTLIST PTLIST PTLIST PTLIST PLOTTR PLOTTR PLOTTR PLOTTR	NSKP NSKP NSKP NSKP NSKP NSKP NSKP NSKP	Increment between plotted samples (Default = 1)
NSR	-	Register Stages	184	506 507	PHENC PHENC	NSR NSR	Number of shift register stages used in generating pseudo-random phase code (NSR ≤ 8)
NSUBP	-	Pulses	96	420 421 453* 454 455* 506 507	FGENXY FGENMP CGENSF PXFRM CGENCW PHENC/FGENXY PHENC/FGENMP	NSUBP NSUBP NSUBP NSUBP NSUBP NSUBP NSUBP	Number of subpulses in transmitted waveform (NSUBP ≤ 300)
NTAPS	-	Taps	101	422 423	DIGTFL DIGTFL	NTAPS NTAPS	Number of taps in transversal digital filter (NTAPS ≤ 100)
NTFN	-	Points	67	401 402	NONLIN NONLIN	NPTS NPTS	Number of points in array defining non-linear transfer function (NTFN ≤ 50)

VARIABLE NAME (SYSTEM)	SYMBOL	UNITS	LOC	MODULE NUMBER	MODULE NAME	VARIABLE NAME (MODULE)	COMMENTS
NTSAR	-	Elements	76	413	ANTARY	NTSAR	Number of elements in TSAR subarray (NTSAR ≤ 100)
				426	TSARY	NTSAR	
				427	TSARY1	NTSAR	
				504	ANTPAT	NTSAR	
				505	TSRPAT	--	
NTYPER	-		45	214	RNDARY	NTYPE	Probability distribution flag
				215	RNDARY	NTYPE	
				235	ADDRND	NTYPE	NTYPE =
				236	ADDRND	NTYPE	1; Uniform
				237	ADRNDC	NTYPE	2; Rayleigh
							3; Gaussian
							4; Uniform 0 ≤ INTEGER < 2**36
							6; Swerling Target Model Nos. 1 & 2
							SIGMA = Average Target Cross-Section
							7; Swerling Target Model Nos. 3 & 4
							SIGMA = Average Target Cross-Section
							8; Sine
NZ	N_z	Zeros	72	407	FILT	NZ	Number of zeros used in specifying a filter (NZ ≤ 50)
				408	FILT	NZ	
N2	-	Bits	1	202	ZFFT	N2	2**N2 = Number of points processed by FFT algorithm (N2 ≤ 13) (Default-Value set by ZFFT/ZIFFT)
				203	ZIFFT	N2	
				301	(SYS)	N2	
				420+	FGENXY	N2	
				421+	FGENMP	N2	
				506+	PHENC/FGENXY	N2	
				507+	PHENC/FGENMP	N2	
				504+	ANTPAT	N2POW	
				512+	ECM	N2	
ORIG		GHz or Ns	38	221	WEITRE	ORIG	Weighting function independent variable offset
				222	WEITCP	ORIG	
				223	WEITMP	ORIG	
PCODE(J) J=1,NSUBP	$\phi(J)$	Degrees	451	420	FGENXY	PCODE(300)	Transmitted waveform phase code
				421	FGENMP	PCODE(300)	
PRI(J) J=1,NPRIS	T(J)	Seconds	130	301	(SYS)	PRI(11)	Array of pulse repetition intervals
PW	τ	Ns	90	420	FGENXY	PW	Transmitted pulsewidth or burst length
				421	FGENMP	PW	
				425*	CGEN	PW	
RADIUS	-	-	195	463	DIGFSF	RADIUS	Radius of circle in z-plane on which poles and zeros are located
				512	ECM	--	

VARIABLE NAME (SYSTEM)	SYMBOL	UNITS	LOC	MODULE NUMBER	MODULE NAME	VARIABLE NAME (MODULE)	COMMENTS
RECDEL	–	Ns	117	426	TSARY	RECDEL	TSAR antenna receive feed network delay line lengths
				427	TSARY1	RECDEL	
				451	RECF	RECDEL	
				452	RECFTF	RECDEL	
				505	TSRPAT	--	
RECIRT	–	Ns	118	451	RECF	RECIRT	TSAR receiver processor impulse response time span
				452	RECFTF	RECIRT	
				505	TSRPAT	--	
RFFØ	f_{RF}	GHz	3	233	DFTRF	FØ	Radiation frequency of the radar
				301	(SYS)	RFFØ	
				413	ANTARY	FØ	
				425+	CGEN	FØ	
				426+	TSARY	FØ	
				427+	TSARY1	FØ	
				453+	CGENSF	RFFØ	
				455+	CGENCW	RFFØ	
				501+	TARGET	FØ	
				502+	TGTNCL	FØ	
				504	ANTPAT	FØ	
				505+	TSRPAT	FØ	
				510+	WVGUID	RFFØ	
				511+	IONOS	RFFØ	
RISTIM	t_r	Ns	98	420	FGENXY	RISTIM	Transmitted pulse rise time (Default = T1)
				421	FGENMP	RISTIM	
				425	CGEN	RISTIM	
				506	PHENC/FGENXY	RISTIM	
				507	PHENC/FGENMP	RISTIM	
RNEXT	–	Ns	51	302	CLINT	RNEXT	Clutter volume range extent
			(6)	503*	CLUTTR	RNEXT	
RNG	–	–	60	303	PTLIST	RNG	Range of independent variable to be plotted
				304	PTLIST	RNG	
				305	PTLIST	RNG	
				306	PTLIST	RNG	
				307	PLOTTR	XIVRNG	
				308	PLOTTR	XIVRNG	
				309	PLOTTR	XIVRNG	
				310	PLOTTR	XIVRNG	
RNGCEL	τ_{cell}	Ns	14	301	(SYS)	RNGCEL	Spacing between impulses which represent clutter as a function of range. IF(RNGCEL = 0.0 & SIMBW ≠ 0.0) RNGCEL = 1.0/SIMBW Also RNGCEL ... II
				302	CLINT	TCELL	
				503*	CLUTTR	TCELL	

VARIABLE NAME (SYSTEM)	SYMBOL	UNITS	LOC	MODULE NUMBER	MODULE NAME	VARIABLE NAME (MODULE)	COMMENTS
RNØ	–	Ns	52	302	CLINT	RNØØØ	Clutter model initial range
			(7)	503*	CLUTTR	RNØØØ	
RSIM	R_T^*	Meters	110	501	TARGET	RØØØ	Target range in simulation for TIME = 0.0 (used to compute time delay only)
				502	TGTNCL	RØØØ	
RTGT	R_T	Meters	107	501	TARGET	RTGTØ	True target range at TIME = 0.0
				502	TGTNCL	RTGTØ	
RWPH	–	Degrees	48	302	CLINT	RWPH	Maximum pulse-to-pulse scatterer phase variation
				503*	CLUTTR	RWPH	
SEDENS	$\int_{s1}^{s2} N_e ds$	Electrons/cm**2	148	511	IONOS	SEDENS	Integrated electron density along propagation path
SF	–	Gain	74	407	FILT	SF	Filter scaling factor
				408	FILT	SF	
				461	DIGFIL	SF	
				462	DIGFNC	SF	
SHPHAS	ϕ_{sh}	Degrees	181	224	SHIFT	THT	Phase angle change
				225	SHIFT	THT	
				226	SHIFTS	THT	
				227	SHIFTS	THT	
				229	RSHIFT	THT	
				230	RSHIFT	THT	
				231	RSHIFTS	THT	
				232	RSHIFT	THT	
				425*	CGEN	THT	
SHTØ	t_{sh}	Ns	180	224	SHIFT	TØ	Time change
				225	SHIFT	TØ	
				226	SHIFTS	TØ	
				227	SHIFTS	TØ	
				229	RSHIFT	TØ	
				230	RSHIFT	TØ	
				231	RSHIFTS	TØ	
				232	RSHIFTS	TØ	
				425*	CGEN	TØ	
SIGMA	σ	Depends on distribution generated	28	101	RRAND	SIGMA	Standard deviation of Gaussian and Rayleigh distributions. Average RCS for Swerling Target Models
				102	RRAND	SIGMA	
SIG2SQ	$-2\sigma^2$	--	30	101*	RRAND	SIG2SQ	Random number generator parameter
				102*	RRAND	SIG2SQ	
SIMBW	B_{sim}	GHz	4	201	DFT	FEXT	Simulation bandwidth (SIMBW ≤ FS) (Default = FS)
				202	ZFFT	SIMBW	
				203	ZIFFT	SIMBW	

VARIABLE NAME (SYSTEM)	SYMBOL	UNITS	LOC	MODULE NUMBER	MODULE NAME	VARIABLE NAME (MODULE)	COMMENTS
SIMBW(cont.)				233	DFTRF	FEXT	
				234	DFTFØ	FEXT	
				301	(SYS)	SIMBW	
				425†	CGEN	SIMBW	
				426†	TSARY	FEXT	
				427†	TSARY1	FEXT	
				454†	PXFRM	SIMBW	
				501†	TARGET	FEXT	
				502†	TGTNCL	FEXT	
				505†	TSRPAT	SIMBW	
SIMFØ	f_0	GHz	8	224	SHIFT	SIMFØ	Center frequency of device or waveform
				225	SHIFT	SIMFØ	
				226	SHIFTS	SIMFØ	
				227	SHIFTS	SIMFØ	
				229	RSHIFT	SIMFØ	
				230	RSHIFT	SIMFØ	
				231	RSHIFTS	SIMFØ	
				232	RSHIFTS	SIMFØ	
				234	DFTFØ	SIMFØ	
				301	(SYS)	SIMFØ	
				420	FGENXY	FO	
				421	FGENMP	FO	
				425	CGEN	SIMFØ	
				453*	CGENSF	SIMFØ	
				454	PXFRM	SIMFØ	
				455*	CGENCW	SIMFØ	
				506	PHENC/FGENXY	FO	
				507	PHENC/FGENMP	FO	
				508†	PHDEC	SIMFØ	(If INPTF ≠ 0, SIMFØ = FØDEC)
				509†	PHDEC	SIMFØ	(If INPTF ≠ 0, SIMFØ = FØDEC)
SPW	τ_s	Ns	95	420	FGENXY	SPW	Subpulse width
				421	FGENMP	SPW	
				453*	CGENSF	SPW	
				454	PXFRM	SPW	
				455*	CGENCW	SPW	
				506	PHENC/FGENXY	SPW	
				507	PHENC/FGENMP	SPW	
ST	-	-	59	303	PTLIST	ST	Plot starting point - independent variable
				304	PTLIST	ST	
				305	PTLIST	ST	
				306	PTLIST	ST	
				307	PLOTTR	XIVST	
				308	PLOTTR	XIVST	
				309	PLOTTR	XIVST	
				310	PLOTTR	XIVST	

VARIABLE NAME (SYSTEM)	SYMBOL	UNITS	LOC	MODULE NUMBER	MODULE NAME	VARIABLE NAME (MODULE)	COMMENTS
SWTIM	τ_{sw}	Ns	97	420	FGENXY	SWTIM	Switching time between subpulses (Default = TI)
				421	FGENMP	SWTIM	
				506	PHENC/FGENXY	SWTIM	
				507	PHENC/FGENMP	SWTIM	
TAVG	τ_{av}	Ns	198	459	CFAR	TAVG	CFAR averaging time interval
				460	CFAR	TAVG	
TAPSPC	T_t	Ns	154	508	PHDEC	TAPSPC	Phase decoder tap spacing (User specified if INPTF = 1; otherwise set to SPW)
				509	PHDEC	TAPSPC	
TCGNOM	-	Ns	89	425	CGEN	TNOM	TSAR control generator nominal pulse spacing
				453	CGENSF	TNOM	
				455	CGENCW	TNOM	
TDLINE	T_a	Ns	86	426	TSARY	ARYDEL	TSAR antenna transmit feed network delay line lengths
				427	TSARY1	ARYDEL	
				505	TSRPAT	--	
TDLMON	-	Ns	185	426	TSARY	TDLMON	Differential delay used to generate TSAR monopulse receive beam
				427	TSARY1	TDLMON	
				505	TSRPAT	--	
TFN(1,J) TFN(2,J) J=1,NTFN	$V_{in}(J)$ $V_{out}(J)$	Input Mag. Output Mag.	201	401	NONLIN	TFN(2,50)	Nonlinear transfer function
				402	NONLIN	TFN(2,50)	
TGTVEL	v_T	Meters/Sec	112	501	TARGET	TGTVEL	Target radial velocity
				502	TGTNCL	TGTVEL	
TH	-	-	65	303	PTLIST	TH	Upper limit of dependent variable to be plotted (NAUTO=1)
				304	PTLIST	TH	
				305	PTLIST	TH	
				306	PTLIST	TH	
THETAR	θ_R	Degrees	119	426	TSARY	THETAR	Receive beam steering angle
				427	TSARY1	THETAR	
				451	RECF	THETAR	
				452	RECFTF	THETAR	
				505	TSRPAT	--	
THETAS	θ_S	Degrees	78	413	ANTARY	THETAS	Transmit beam steering angle
				425	CGEN	THETAS	
				426	TSARY	THETAS	
				427	TSARY1	THETAS	
				453	CGENSF	THETAS	
				455	CGENCW	THETAS	
				504	ANTPAT	THETAS	
				505	TSRPAT	--	

VARIABLE NAME (SYSTEM)	SYMBOL	UNITS	LOC	MODULE NUMBER	MODULE NAME	VARIABLE NAME (MODULE)	COMMENTS
TI	Δt	Ns	12	201+	DFT	TI	Time sampling increment
				233+	DFTRF	TI	IF(FS ≠ 0.0) TI = 1.0/FS
				234+	DFTFØ	TI	
				301	(SYS)	TI	
				302+	CLINT	TI	
				420+	FGENXY	TI	
				421+	FGENMP	TI	
				425+	CGEN	TI	
				503+	CLUTTR	TI	
				506+	PHENC/FGENXY	TI	
				507+	PHENC/FGENMP	TI	
TIME	t^*	Seconds	16	301	(SYS)	TIME	Elapsed time
				501+	TARGET	TIME	
				502+	TGTNCL	TIME	
				503+	CLUTTR	TIME	
				512+	ECM	TIME	
TIMLSB	-	Ns	115	425	CGEN	TIMLSB	Pulse timing least significant bit size
TJIT	-	Ns	182	229	RSHIFT	TJIT	Time shift jitter
				230	RSHIFT	TJIT	
				231	RSHIFTS	TJIT	
				232	RSHIFTS	TJIT	
TL	-	-	66	303	PTLIST	TL	Lower limit of dependent variable to be plotted (NAUTO = 1)
				304	PTLIST	TL	
				305	PTLIST	TL	
				306	PTLIST	TL	
TLIM	-	-	39	208	CUMDIS	TLIM	Upper bound of histogram
				209	CUMDIS	TLIM	
TORINT	ϕ_T	Degrees	109	501	TARGET	TORINT	Target orientation angle
				502	TGTNCL	TORINT	
TSCAT(1,J) TSCAT(2,J) TSCAT(3,J) J=1,NSCAT	$\sigma(J)$ $r(J)$ $\gamma(J)$	Square Meters Meters Degrees	201	501 502	TARGET TGTNCL	TSCAT(3,100) TSCAT(3,100)	Target discrete scatterer parameters
TSRLOS(J) J=1,NTSAR	$g_a(J)$	Gain	401	413	ANTARY	TSRLOS(100)	TSAR antenna distributed feed network losses
				426	TSARY	TSRLOS(100)	
				504	ANTPAT	TSRLOS(100)	
				505	TSRPAT	--	
TSTART	-	Ns	100	420	FGENXY	TSTART	Transmitted pulse starting time
				421	FGENMP	TSTART	
				425*	CGEN	TSTART	

VARIABLE NAME (SYSTEM)	SYMBOL	UNITS	LOC	MODULE NUMBER	MODULE NAME	VARIABLE NAME (MODULE)	COMMENTS
TSTART(cont.)				506	PHENC/FGENXY	TSTART	
				507	PHENC/FGENMP	TSTART	
UEXT	-	-	26	101	RRAND	UUEXT	Width of uniform distribution
				102	RRAND	UUEXT	
UL	-	--	31	101*	RRAND	UL	Lower bound of uniform distribution
				102*	RRAND	UL	
UMEAN	-	-	25	101	RRAND	UMEAN	Mean of uniform distribution
				102	RRAND	UMEAN	
VDL(J) J=1,12	-		251	307	PLOTTR	VDL(12)	Plot dependent variable label
				308	PLOTTR	VDL(12)	
				309	PLOTTR	VDL(12)	
				310	PLOTTR	VDL(12)	
VELANG	-	Degrees	50	302	CLINT	VELANG	Wind velocity vector angle
VIL(J) J=1,12	-	-	201	307	PLOTTR	VIL(12)	Plot independent variable label
				308	PLOTTR	VIL(12)	
				309	PLOTTR	VIL(12)	
				310	PLOTTR	VIL(12)	
VPEAK	V_T	Volts	129	420	FGENXY	VPEAK	Transmitter peak output voltage (Default = 1.0)
				421	FGENMP	VPEAK	
				506	PHENC/FGENXY	VPEAK	
				507	PHENC/FGENMP	VPEAK	
WNDVEL	v_w	Meters/Sec	49	302	CLINT	WNDVEL	Wind velocity vector magnitude
WSCAN	w_s	Deg/Sec	10	301	(SYS)	WSCAN	Antenna scan rate
WT(1,J)	x(J)	Real-Gain	201	221	WEITRE	WT(3,100)	Array containing sampled weighting function
WT(2,J)	t(J)∝f(J)	Ns or GHz		222	WEITCP	WT(3,100)	
WT(3,J) J=1,NPWT	y(J)	Imag.-Gain					
WT(1,J)	g(J)	Gain	201	223	WEITMP	WT(3,100)	Array containing sampled weighting function
WT(2,J)	t(J)∝f(J)	Ns or GHz					
WT(3,J) J=1,NPWT	ϕ(J)	Degrees					
WTX(1,J)	g(J)	Gain	201	420	FGENXY	WT(3,100)	Array containing sampled transmitter complex envelope
WTX(2,J)	t(J)	Ns		421	FGENMP	WT(3,100)	
WTX(3,J) J=1,NPWTX	ϕ(J)	Degrees		425	CGEN	WT(3,100)	

VARIABLE NAME (SYSTEM)	SYMBOL	UNITS	LOC	MODULE NUMBER	MODULE NAME	VARIABLE NAME (MODULE)	COMMENTS
XLSB		Volts	103	216 217	ATOD ATOD	XLSB XLSB	A-to-D converter least significant bit size
XMEAN	-	-	27	101 102	RRAND RRAND	XMEAN XMEAN	Mean of Gaussian distribution
XUEXT	-	-	32	101* 102*	RRAND RRAND	UEXT UEXT	Random number generator parameter
XVLANG	-	Radians	125 (19)	302* 503*	CLINT CLUTTR	XVLANG XVLANG	Clutter model parameter
XWLENG	z	Meters	147	510	WVGUID	XWLENG	Length of waveguide run
				A D D E N D A			
ACYL	-	Inches	201	513	SCYL	A	Radius of cylinder
ANBAZØ	$B\Psi_\Phi$	Degrees	150	311	(BISTAT -SYS)	ANBAZØ	Initial receiving antenna azimuth angle
ANBELØ	BE_Φ	Degrees	151	311	(BISTAT -SYS)	ANBELØ	Initial receiving antenna elevation angle
BASLIN	-	Meters	19	311	(BISTAT -SYS)	BASLIN	Baseline length between transmit and receive antennas
CHFAZ	-	Degrees	215	514 515	CHAFF CHAFF	AZCHFF AZCHFF	Azimuth to centroid of chaff cloud
CHFHGT	-	Meters	214	514 515	CHAFF CHAFF	HCHAFF HCHAFF	Height of centroid of chaff cloud
CHFRNG	-	Meters	213	514 515	CHAFF CHAFF	RCCENT RCCENT	Range to centroid of chaff cloud

VARIABLE NAME (SYSTEM)	SYMBOL	UNITS	LOC	MODULE NUMBER	MODULE NAME	VARIABLE NAME (MODULE)	COMMENTS
DIPDIA	a	Inches	220	464 465 514 515	DIPOLE DIPOLE CHAFF CHAFF	DIA DIA - -	Dipole Diameter
DIPLNG	X_L	Inches	219	464 465 514 515	DIPOLE DIPOLE CHAFF CHAFF	XL XL - -	Dipole length
DORINT (1,J) (2,J) (3,J)	 θ_D D r_D	 Degrees Degrees Meters	321	514 515	CHAFF CHAFF	DORINT (3,100)	Chaff cloud dipole orientations
HCYL	-	Inches	202	513	SCYL	H	Half-length of cylinder
IPOL	-	-	205	513	SCYL	IPOL	Polarization Flag =1, VV Polarization =2, HH Polarization
NDIPOL	-	-	212	514 515	CHAFF CHAFF	NDIPOL NDIPOL	Number of dipoles used in chaff model
RHOD	D	Degrees	217	464 465	DIPOLE DIPOLE	RHO RHO	Dipole orientation angle with respect to E-field vector
THETAD	θ_D	Degrees	216	464 465	DIPOLE DIPOLE	THETA THETA	Dipole azimuth angle with respect to propagation vector
TSHFTD	-	Ns	218	464	DIPOLE	TSHFT	Time delay for computing dipole transfer function
WSCANB	-	Deg/Sec	17	311	(BISTAT -SYS)	WSCANB	Receiving antenna scan rate

Table C-2 MODULE VARIABLE NAME/SYSTEM VARIABLE NAME CROSS REFERENCE TABLE

MODULE VARIABLE NAME	SYSTEM VARIABLE NAME
ANTANG	AZANG or ELANG
ANTP	ANTAZ or ANTEL
ARYDEL	TDLINE
AZØØØ	AZØ
BSIT	AZBST or ELBST
CODE	ICODE
DELTHE	ADELT
DIN	DFTIN
ELØØØ	ELØ
FB	FBCOEF
FBX	FBR
FBXY	FBI
FEXT	SIMBW
FF	FFCOEF
FFX	FFR
FFXY	FFI
FSTART	FSTRT
FØ	RFFØ or SIMFØ
FØXMT	FSTRT
IC	IFCODE
ICPLXF	ICFOR
ICPLXI	ICINV
IDMP	IDDUMP
IDMY	IDDUMP
IDMY1	IDDUMP
INORM	NORMFT
MAD1	IADD1
NBITS	NBITDF
NIXF	NHIST
NP	NSEC
NPT	NPTAZ, NPTEL or NIMP
NPTS	NRNDPT or NTFN
NPULS	NIMP
NSUBP	NCGPLS
NTYPE	NTYPER
N2POW	N2
RNØØØ	RNØ
RTGTØ	RTGT
RØØØ	RSIM
STARPT	ASTRT
STOPT	ASTOP
TCELL	RNGCEL

Table C-2 MODULE VARIABLE NAME/SYSTEM VARIABLE NAME CROSS REFERENCE TABLE
(Page 2 of 2)

MODULE VARIABLE NAME	SYSTEM VARIABLE NAME
THT	SHPHAS
TNOM	TCGNOM
TØ	SHTØ
UEXT	XUEXT
UUEXT	UEXT
WT	WTX
XIVRNG	RNG
XIVST	ST
ADDENDA	
A	ACYL
AZCHFF	CHFAZ
DIA	DIPDIA
H	HCYL
HCHAFF	CHFHGT
RCCENT	CHFRNG
RHO	RHOD
THETA	THETAD
TSHFT	TSHFTD
XL	DIPLNG

APPENDIX D

TABLE OF

TIME SHARING FILES

The table contained herein is a list of the files in the radar simulation model. In the left column, the file or /catalog/file designation that includes the password is listed. The files beginning with the letter "S" are the Fortran-IV decks, and those beginning with the letter "O" are the object decks. In the right column is the list of modules that are located in the corresponding file in the left columns.

The Job Definition Files are those used to run the sample problems in Section 8 of Volume I and Section 4 of Volume III.

Table D-1 TIME SHARING FILES

BECAGD01 FILES

*LODREX$RJH	MAIN1
*OLODR$RJH	MAIN1
*SUPRT1$RJH	IPACK; RRAND; DBLKX; BLOCK DATA
*OSUP1$RJH	IPACK; RRAND; DBLKX; BLOCK DATA
*SCLINT$RJH	CLINT
*OCLINT$RJH	CLINT
*SXMTR1$RJH	PHENC
*OXMTR1$RJH	PHENC
*OARSIN$RJH	ARSIN
*SIMEX$RJH	MAIN2
*OSIMEX$RJH	MAIN2
*SZFFT$RJH	ZFFT
*OZFFT$RJH	ZFFT
*SDFIN$RJH	DCFAR; DIGTFL; CDIGFL; INGTOR; ATOD; RDIGFL; DIGFIL; ECM; DIGFSF
*ODFIN$RJH	DCFAR; DIGTFL; CDIGFL; INGTOR; ATOD; RDIGFL; DIGFIL; ECM; DIGFSF
*SXMTR2$RJH	FGENXY; PHDEC; ABORT
*OXMTR2$RJH	FGENXY; PHDEC; ABORT
*SPLOTS$RJH	PTLIST; PLOTTR
*OPLOTS$RJH	PTLIST; PLOTTR
*SMISC1$RJH	FILT; WEITRE; CONV; SHIFT; CFAR; LAMPCP; ERGYCP
*OMISC1$RJH	FILT; WEITRE; CONV; SHIFT; CFAR; LAMPCP; ERGYCP
*STSAR1$RJH	RECF; PXFRM; CGENSF
*OTSAR1$RJH	RECF; PXFRM; CGENSF
*/BLOCK1$RJH/SMISC2$RJH	NONLIN; HWDET; ANTINT; DFT
*/BLOCK1$RJH/OMISC2$RJH	NONLIN; HWDET; ANTINT; DFT
*/BLOCK1$RJH/SUPRT2$RJH	RNDARY; CUMDIS; RTOPDB; AZGAIN; ELGAIN
*/BLOCK1$RJH/OSUP2$RJH	RNDARY; CUMDIS; RTOPDB; AZGAIN; ELGAIN

```
*/BLOCK1$RJH/SANT1$RJH          ANTARY;PLTFMT
*/BLOCK1$RJH/OANT1$RJH          ANTARY;PLTFMT

*/BLOCK1$RJH/SANT2$RJH          SCANNR;SPCAVG
*/BLOCK1$RJH/OANT2$RJH          SCANNR;SPCAVG

*/BLOCK1$RJH/STGCL$RJH          TARGET;CLUTTR;WVGUID;IONOS
*/BLOCK1$RJH/OTGCL$RJH          TARGET;CLUTTR;WVGUID;IONOS

*SSTSAR$RJH                     TSRPAT;CGEN;TSARY
*/BLOCK1$RJH/OTSAR$RJH          TSRPAT;CGEN;TSARY

*/BLOCK1$RJH/SDIG$RJH           MTIFLT;SWPINT
*/BLOCK1$RJH/ODIG$RJH           MTIFLT;SWPINT

*TAPEIN                         ASSEMBLY LANG PROG TO READ TAPE INTO BUFF
*CKTAPE                         PROGRAM TO VERIFY RCS MAG TAPES
*TAPTBL                         TAPES SENT TO RADC
```

JOB DEFINITON FILES

RANJB	I,8.2	WGDISP	I,8.16
ENDIST	I,8.3	IMAGEM	I,8.17
DFTPRB	I,8.4	CHAFFM	I,8.18
NONLNP	I,8.5	BISTAT	I,8.19
BARKER	I,8.6	TXCODE	I,8.20
WBTGT1/2	I,8.7	DECODE	I,8.21
WBTGCL	I,8.8	DHPROB	I,8.22
NBTGCL	I,8.9	RAINPB	I,8.23
WAPCG	I,8.10	RCSSP	I,8.24
ANTNNA1	I,8.11	TSARBP	III,4.1
TSARBK	I,8.12	CGENOT	III,4.2
ECMODL	I,8.13	TSARTM	III,4.3
DIKFIX	I,8.14	TSARJB	III,4.4
CFARMD	I,8.15	FSANT	III,4.5

SELECTED BECAVU01 FILES

```
*SIMAGP                         IMAGP;ERRPRC
*OIMAGP                         IMAGP;ERRPRC

*/RCSM$JR/SCHAFF                DIPOLE;CHAFF;EXPI
*/RCSM$JR/OCHAFF                DIPOLE;CHAFF;EXPI

*/RCSM$JR/SCYL                  SCYL;BISTGT
*/RCSM$JR/OCYL                  SCYL;BISTGT

*/RCSM$JR/SXSA                  GAM;BESS
*/RCSM$JR/OSXSA                 GAM;BESS
```

APPENDIX E

TCHEBYSCHEFF FILTER

DESIGN DATA

Given the Tschebyscheff approximation of a low-pass filter, i.e.

$$\left|F(j\omega)\right|^2 = \frac{1}{1 + \delta^2 T_n^2(\omega)} \quad ,$$

where $F(j\omega)$ is the transfer function,

δ is the ripple factor (i.e., $1 - \frac{1}{(1 + \delta^2)^{\frac{1}{2}}}$ is the peak-to-peak ripple), and

$T_n(\omega)$ is a Tschebyscheff polynomial of order n, i.e.,

$$T_n(\omega) = \cos(n \cos^{-1}\omega), \ |\omega| \leq 1$$

$$= \cosh(n \cosh^{-1}\omega), \ |\omega| > 1;$$

then it can be shown that the k^{th} pole, S_k, of the transfer function $F(j\omega)$ is determined as follows:

$$S_k = \sigma_k + j\omega_k$$

$$\sigma_k = -\sinh\left(\frac{1}{n} \sinh^{-1} 1/\delta\right) \sin \frac{(2k-1)\pi}{2n}$$

$$\omega_k = \cosh\left(\frac{1}{n} \sinh^{-1} 1/\delta\right) \cos \frac{(2k-1)\pi}{2n}$$

where $F(j\omega) = \frac{1}{(1 + \delta^2)^{\frac{1}{2}}}$ when $\omega = 1$.

By setting $1 + \delta^2 T_n^2(\omega) = 2$ and solving for ω, we can determine a normalization factor for the poles such that $F^2(j1) = \frac{1}{2}$, i.e., the filter response will be -3 dB with respect to the ripple peak at $\omega = 1$. This normalization factor is derived as follows:

$$\cosh(n \cosh^{-1} \omega_1) = 1/\delta$$

$$\omega_1 = \cosh \frac{1}{n} \cosh^{-1} 1/\delta$$

$$= \cosh \frac{1}{n} \sinh^{-1} \sqrt{\frac{1-\delta}{\delta^2}} .$$

If each pole is divided by this factor the response will be -3 db with respect to the peak response. It may be noted that, if the order of the polynomial is odd, the peak response is identical to the response at $\omega = 0$. Thus, the above formula will provide normalization to the DC response of the filter. However, if n is even, the response at $\omega = 0$ is identical to that at the lower limit of the ripple; and, if it is desired to normalize the Tchebyscheff response with respect to the DC level of an even pole filter, a different factor must be used. This factor is derived as follows:

$$T_n^2(0) = 1 \text{ for even } n$$

$$|F(j0)|^2 = \frac{1}{1 + \delta^2 T_n^2(0)} = \frac{1}{1 + \delta^2}$$

$$|F(j\omega_{3dB})|^2 = \frac{1}{2(1 + \delta^2)} = \frac{1}{1 + \delta^2 T_n^2(j\omega_{3dB})}$$

solving for ω_{3dB},

$$T_n^2(j\omega_{3dB}) = \frac{2(1 + \delta^2)-1}{\delta^2} = \frac{2\delta^2 + 1}{\delta^2}$$

$$\cosh(n \cosh^{-1} \omega_{3dB}) = \frac{2\delta^2 + 1}{\delta^2}$$

$$\omega_{3dB} = \cosh \frac{1}{n} \cosh^{-1} \frac{(2\delta^2 + 1)^{\frac{1}{2}}}{\delta}$$

$$= \cosh \frac{1}{n} \sinh^{-1} \frac{(1 + \delta^2)^{\frac{1}{2}}}{\delta}$$

Table B-1 contains the pole locations for Tchebyscheff filters of order 1 through 10 for various ripple factors. The poles are normalized for $|F(1)|^2 = F(\omega_{peak})^2/2$.

TABLE E-1 TCHEBYSCHEFF FILTER NORMALIZED POLE LOCATIONS

$\delta = 0.15262042$ RIPPLE = 0.1 dB

Pole Nr. / Nr. Poles	1		2		3		4		5	
	σ	ω	σ	ω	σ	ω	σ	ω	σ	ω
1	-1.0	0								
2	-.61041904	.71064977								
3	-.34895944	.86836557	-.69791888	0						
4	-.21775331	.92540643	-.52570299	.38331590						
5	-.14676218	.95210617	-.38422837	.58843397	-.47493238	0				
6	-.10494112	.96668431	-.28670448	.70766203	-.39164560	.25902228				
7	-.07850274	.97549887	-.21995978	.78228936	-.31785109	.43413784	-.35278809	0		
8	-.06082185	.98122944	-.17320598	.83184615	-.25922107	.55582183	-.30577210	.19517867		
9	-.04845365	.98516257	-.13951672	.86633742	-.21375202	.64301920	-.26220567	.34214337	-.27903344	0
10	-.03948065	.98797802	-.11457731	.89126784	-.17845835	.70731417	-.22487063	.45412365	-.24927102	.15648035

Note: Only the poles in the second quadrant are shown. The conjugate of all complex poles is implied.

TABLE E-1 TCHEBYSCHEFF FILTER NORMALIZED POLE LOCATIONS (cont'd)

δ = 0.21709111 RIPPLE = 0.2 dB

Pole Nr. / Nr. Poles	1		2		3		4		5	
	σ	ω	σ	ω	σ	ω	σ	ω	σ	ω
1	-1.0	0								
2	-.57550005	.71384111								
3	-.31735974	.87031820	-.63471948	0						
4	-.19441483	.92662976	-.46935891	.38382261						
5	-.12972133	.95292837	-.33961485	.58894212	-.41978704	0				
6	-.09220663	.96727048	-.25191320	.70809113	-.34411983	.25917934				
7	-.06871748	.97593635	-.19254210	.78264019	-.27823139	.43433254	-.30881355	0		
8	-.05310658	.98156780	-.15123475	.83213300	-.22633880	.55601349	-.26698482	.19524597		
9	-.04223279	.98543177	-.12160446	.86657416	-.18630885	.64319491	-.22854163	.34223686	-.24320893	0
10	-.03436782	.98819715	-.09973931	.89146553	-.15534761	.70747105	-.19574941	.45422438	-.21698990	.15651505

Note: Only the poles in the second quadrant are shown. The conjugate of all complex poles is implied.

TABLE E-1 TCHEBYSCHEFF FILTER NORMALIZED POLE LOCATIONS (cont'd)

$\delta = 0.26743094$ RIPPLE = 0.3 dB

Pole Nr. / Nr. Poles	1		2		3		4		5	
	σ	ω	σ	ω	σ	ω	σ	ω	σ	ω
1	-1.0	0								
2	-.55032824	.71684276								
3	-.29668017	.87209522	-.59336034	0						
4	-.17979926	.92772716	-.43407381	.38427717						
5	-.11929080	.95366066	-.31230736	.58939470	-.38603313	0				
6	-.08451407	.96779045	-.23089673	.70847178	-.31541080	.25931867				
7	-.06285494	.97632347	-.17611562	.78295063	-.25449444	.43450482	-.28246752	0		
8	-.04850939	.98186672	-.13814307	.83238641	-.20674571	.55618282	-.24387320	.19530543		
9	-.03854011	.98566934	-.11097183	.86678307	-.17001871	.64334997	-.20855883	.34231937	-.22194367	0
10	-.03134120	.98839038	-.09095571	.89163984	-.14166684	.70760939	-.17851063	.45431319	-.19788056	.15654566

Note: Only the poles in the second quadrant are shown. The conjugate of all complex poles is implied.

TABLE E-1 TCHEBYSCHEFF FILTER NORMALIZED POLE LOCATIONS (cont'd)

δ = 0.34931140 RIPPLE = 0.5 dB

Pole Nr. / Nr. Poles	1		2		3		4		5	
	σ	ω	σ	ω	σ	ω	σ	ω	σ	ω
1	-1.0	0								
2	-.51290914	.72246593								
3	-.26829311	.87532371	-.53658623	0						
4	-.16041786	.92969636	-.38728296	.38509284						
5	-.10569927	.95496685	-.27672429	.59020197	-.34205003	0				
6	-.07458969	.96871487	-.20378283	.70914851	-.27837252	.25956637				
7	-.05533807	.97701031	-.15505382	.78350144	-.22405927	.43481050	-.24868702	0		
8	-.04263892	.98239640	-.12142538	.83283546	-.18172593	.55648286	-.21436034	.19541079		
9	-.03383799	.98608991	-.09743261	.86715292	-.14927542	.64362448	-.18311341	.34246545	-.19486522	0
10	-.02749505	.98873224	-.07979375	.89194824	-.12428167	.70785413	-.15660404	.45447033	-.17359692	.15659980

Note: Only the poles in the second quadrant are shown. The conjugate of all complex poles is implied.

TABLE E-1 TCHEBYSCHEFF FILTER NORMALIZED POLE LOCATIONS (cont'd)

δ = 0.41820755 RIPPLE = 0.7 dB

Pole Nr. / Nr. Poles	1		2		3		4		5	
	σ	ω	σ	ω	σ	ω	σ	ω	σ	ω
1	-1.0	0								
2	-.48446310	.72772871								
3	-.24818522	.87826076	-.49637045	0						
4	-.14709201	.93146839	-.35511153	.38582684						
5	-.09649247	.95613623	-.25262057	.59092469	-.31225619	0				
6	-.06792332	.96954015	-.18556996	.70975265	-.25349327	.25978750				
7	-.05031500	.97762246	-.14097948	.78399234	-.20372126	.43508292	-.22611354	0		
8	-.03872942	.98286795	-.11029205	.83323522	-.16506371	.55674997	-.19470592	.19550459		
9	-.03071395	.98646405	-.08843730	.86748193	-.13549380	.64386868	-.16620775	.34259537	-.17687459	0
10	-.02494406	.98903619	-.07239047	.89222244	-.11275081	.70807174	-.14207430	.45461004	-.15749058	.15664794

Note: Only the poles in the second quadrant are shown. The conjugate of all complex poles is implied.

TABLE E-1 TCHEBYSCHEFF FILTER NORMALIZED POLE LOCATIONS (cont'd)

δ = 0.50884714 RIPPLE = 1.0 dB

Pole Nr. / Nr. Poles	1		2		3		4		5	
	σ	ω	σ	ω	σ	ω	σ	ω	σ	ω
1	-1.0	0								
2	-.45076823	.73514239								
3	-.22567588	.88229691	-.45135176	0						
4	-.13251257	.93388164	-.31991365	.38682644						
5	-.08653231	.95772210	-.22654452	.59190481	-.28002442	0				
6	-.06075675	.97065684	-.16599053	.71057012	-.22674728	.26008672				
7	-.04493586	.97844963	-.12590747	.78465568	-.18194156	.43545105	-.20193990	0		
8	-.03455338	.98350459	-.09839970	.83377493	-.14726555	.55711060	-.17371156	.19563123		
9	-.02738277	.98696887	-.07884554	.86792586	-.12079837	.64419818	-.14818114	.34277069	-.15769107	0
10	-.02222734	.98944613	-.06450624	.89259225	-.10047083	.70836522	-.12660063	.45479847	-.14033788	.15671287

Note: Only the poles in the second quadrant are shown. The conjugate of all complex poles is implied.

TABLE E-1 TCHEBYSCHEFF FILTER NORMALIZED POLE LOCATIONS (cont'd)

$\delta = 0.64229086$ RIPPLE = 1.5 dB

Pole Nr. / Nr. Poles	1		2		3		4		5	
	σ	ω	σ	ω	σ	ω	σ	ω	σ	ω
1	-1.0	0								
2	-.40779353	.74658558								
3	-.19865287	.88835170	-.39730574	0						
4	-.11541929	.93746599	-.27864681	.38831113						
5	-.07498787	.96006691	-.19632080	.59335398	-.24266585	0				
6	-.05250299	.97230390	-.14344084	.71177586	-.19594383	.26052805				
7	-.03876473	.97966790	-.10861635	.78563265	-.15695517	.43599323	-.17420710	0		
8	-.02977466	.98444135	-.08479106	.83456908	-.12689879	.55764123	-.14968733	.19581756		
9	-.02357751	.98771119	-.06788874	.86857865	-.10401158	.64468269	-.12758909	.34302850	-.13577747	0
10	-.01912789	.99004866	-.05551131	.89313580	-.08646089	.70879659	-.10894708	.45507542	-.12076877	.15680830

Note: Only the poles in the second quadrant are shown. The conjugate of all complex poles is implied.

TABLE E-1 TCHEBYSCHEFF FILTER NORMALIZED POLE LOCATIONS (cont'd)

δ = 0.76478310 RIPPLE = 2.0 dB

Pole Nr. / Nr. Poles	1		2		3		4		5	
	σ	ω	σ	ω	σ	ω	σ	ω	σ	ω
1	-1.0	0								
2	-.37416689	.75720472								
3	-.17860959	.89382276	-.35721919	0						
4	-.10299556	.94067582	-.24865328	.38964068						
5	-.06667806	.96215824	-.17456543	.59464650	-.21577474	0				
6	-.04659352	.97376976	-.12729586	.71284894	-.17388937	.26092082				
7	-.03436071	.98075074	-.09627656	.78650103	-.13912367	.43647514	-.15441562	0		
8	-.02637157	.98527329	-.07509987	.83527436	-.11239489	.55811249	-.13257882	.19598304		
9	-.02087161	.98837008	-.06009740	.86915806	-.09207456	.64511275	-.11294616	.34325733	-.12019480	0
10	-.01692620	.99058325	-.04912174	.89361806	-.07650891	.70917931	-.09640685	.45532115	-.10686781	.15689297

Note: Only the poles in the second quadrant are shown. The conjugate of all complex poles is implied.

TABLE E-1 TCHEBYSCHEFF FILTER NORMALIZED POLE LOCATIONS (cont'd)

δ = 0.99762835 RIPPLE = 3.0 dB

Pole Nr. / Nr. Poles	1		2		3		4		5	
	σ	ω	σ	ω	σ	ω	σ	ω	σ	ω
1	-1.0	0								
2	-.32225836	.77669610								
3	-.14927069	.90357584	-.29854138	0						
4	-.08515775	.94634388	-.20558900	.39198847						
5	-.05485466	.96583567	-.14361136	.59691927	-.17751340	0				
6	-.03822699	.97634157	-.10443808	.71473163	-.14266507	.26160993				
7	-.02814428	.98264803	-.07885851	.78802253	-.11395386	.43731951	-.12647924	0		
8	-.02157736	.98672971	-.06144711	.83650906	-.09196210	.55893748	-.10847669	.19627274		
9	-.01706470	.98952288	-.04913584	.87017182	-.07528048	.64586519	-.09234518	.34365769	-.09827169	0
10	-.01383163	.99151820	-.04014096	.89446149	-.06252102	.70984866	-.07878108	.45575089	-.08732949	.15704105

Note: Only the poles in the second quadrant are shown. The conjugate of all complex poles is implied.

APPENDIX F

DIGITAL FILTER DESIGN

F.1 THE BILINEAR Z-TRANSFORMATION

The bilinear Z-transformation is a convenient means of converting an S-domain transfer function into a Z-domain transfer function which is compatible with digital filter design techniques. Of particular interest in this appendix is the use of the Z-transform to obtain high-pass or low-pass digital filter designs from normalized (i.e., $\omega_{3db} = 1$) S-domain low-pass filter transfer functions. The bilinear Z-transformation is defined by the following expression:

$$S = \frac{2}{T}\,\frac{1-Z^{-1}}{1+Z^{-1}} \qquad \text{(F-1)}$$

where T is the discrete sampling interval. This transformation maps the entire left-half of the S-plane into the area inside the Z-plane unit circle, and maps the right-half S-plane into the area outside of the unit circle. The S-plane $j\omega$ axis becomes the unit circle with $j\omega=0$ mapped to Z = +1 and $j\omega=\pm\infty$ mapped to Z = -1. This results in a non-linear warping of the frequency scale according to the relation

$$\frac{\omega_c T}{2} = \tan\left(\frac{\omega_d T}{2}\right) = \Omega \qquad \text{(F-2)}$$

where ω_c is the S-plane frequency and ω_d is the corresponding Z-plane frequency. For convenience, the parameter Ω will be used to represent $\tan\left(\frac{\omega_d T}{2}\right)$ in the remainder of this appendix. Compensation can be made for the warping effect of the bilinear Z-transform by prewarping the filter cutoff frequency. This is accomplished by solving equation F-2 for T/2 and substituting the resulting expression into equation F-1.

$$S = \frac{\omega_c}{\Omega}\,\frac{1-Z^{-1}}{1+Z^{-1}}. \qquad \text{(F-3)}$$

F.1.1 Low Pass to Low Pass (High Pass to High Pass) Transformation

In order to transform a normalized S-plane filter design (ω_c=1) to a Z-plane representation with cutoff frequency ω_d, equation F-3 is solved for Z after 1.0 is substituted for ω_c. The following equation gives the relationship between the S-plane and Z-plane poles (zeros).

$$Z = \frac{1/\Omega + S}{1/\Omega - S} \qquad \text{(F-4)}$$

F.1.2 Low Pass to High Pass (High Pass to Low Pass) Transformation

In order to transform a low pass S-plane transfer function to its high pass complement in the Z-plane, the following complementary transformation in the S-plane is performed first

$$S = 1/S' \qquad \text{(F-5)}$$

where S' is the new pole (zero) location in the S-plane. When the substitution specified by equation F-5 is made in equation F-4 the following transform is obtained

$$Z = \frac{1/\Omega + 1/S'}{1/\Omega - 1/S'}$$

$$= \frac{S' + \Omega}{S' - \Omega}. \qquad \text{(F-6)}$$

F.2 DETERMINING DIGITAL FILTER COEFFICIENTS

Once the transfer function of a filter has been determindd in the Z-plane, it is a simple procedure to determine the feedforward and feedback coefficients of a digital filter.

Assume the Z-plane transfer function is defined by the following equation.

$$H(Z) = K_1K_2 \frac{(Z-Z_{01})(Z-Z_{01}^*)(Z-Z_{02})(Z-Z_{02}^*)}{(Z-Z_{p1})(Z-Z_{p1}^*)(Z-Z_{p2})(Z-Z_{p2}^*)}$$

where the asterisk indicates the complex conjugate. This equation can be rewritten in the form

$$H(Z) = K_1 \frac{(Z-Z_{01})(Z-Z_{01}^*)}{(Z-Z_{p1})(Z-Z_{p1}^*)} \cdot K_2 \frac{(Z-Z_{02})(Z-Z_{02}^*)}{(Z-Z_{p2})(Z-Z_{p2}^*)} \qquad \text{(F-7)}$$

The second form of this equation indicates that any physically realizable transfer function can be implemented by cascading quadratic filter sections. Therefore, the analysis can be limited to a single quadratic section with no loss in generality. One section of equation F-7 is expanded to give the following

$$G(Z) = K \frac{Z^2 - 2ZRe\{z_o\} + |Z_o|^2}{Z^2 - 2ZRe\{z_p\} + |Z_p|^2}, \qquad \text{(F-8)}$$

where Re{ } represents the real part of { }.

Since this is a quadratic in Z, it should be possible to implement the function by a double delay filter as shown in Figure F.1-1. The transfer function for this filter will now be determined and compared with equation F-8 above.

$$E_o = \left[\frac{1}{Z^2} E_2 + B_2 \frac{1}{Z} E_2 + B_1 E_2\right] C \qquad \text{(F-9)}$$

$$E_2 = E_i + A_1 \frac{1}{Z} E_2 + A_2 \frac{1}{Z^2} E_2 . \qquad \text{(F-10)}$$

By solving equation F-10 for E_2 and substituting into equation F-9, the following expression is obtained.

$$\frac{E_o}{E_i} = C\left[\frac{B_1 Z^2 + B_2 Z + 1}{Z^2 - A_1 A - A_2}\right]. \qquad \text{(F-11)}$$

If B_1 is factored from the numerator, the following expression results:

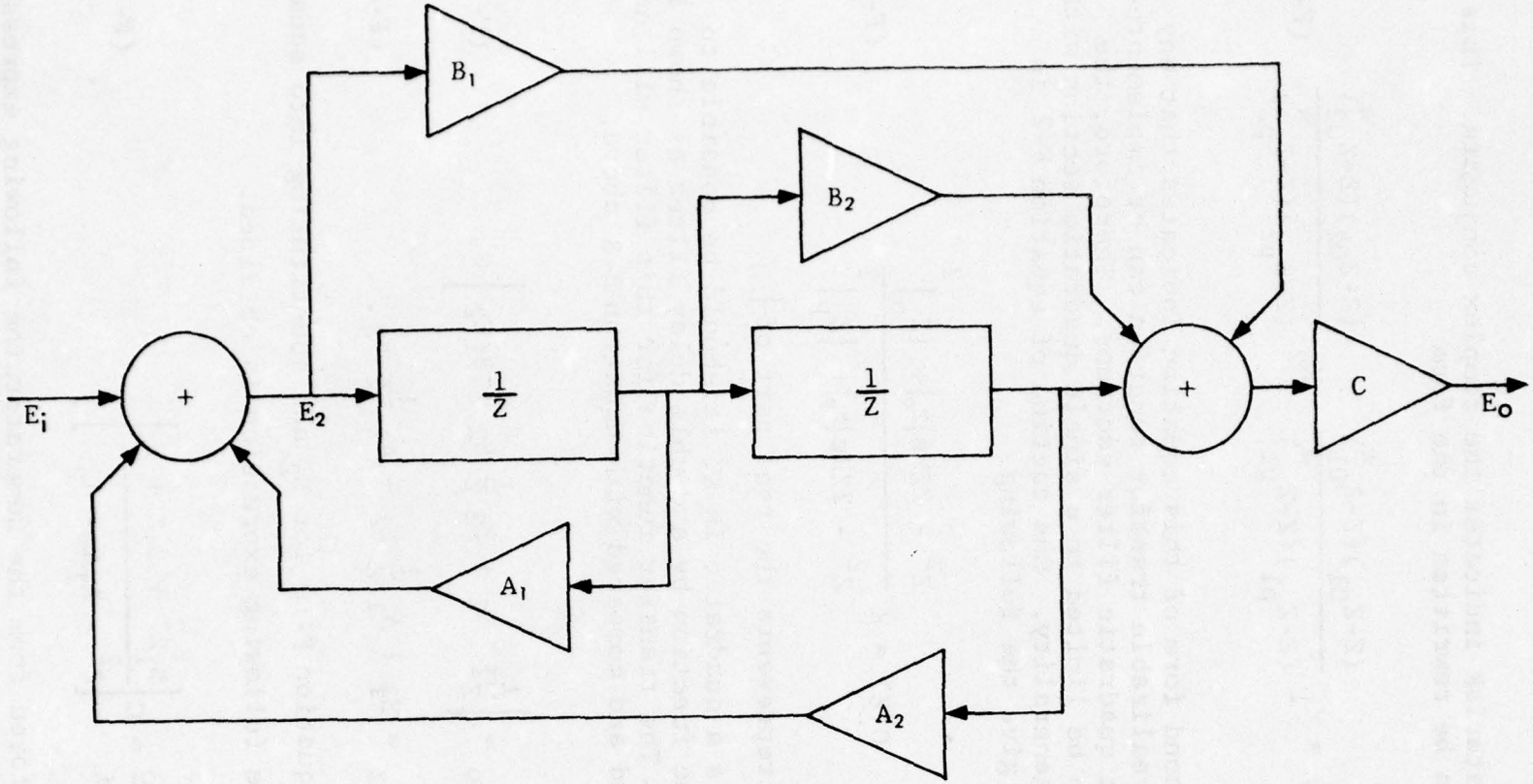


Figure F.1-1 DOUBLE-DELAY DIGITAL FILTER DIAGRAM

$$\frac{E_o}{E_i} = CB_1\left[\frac{Z^2 + \frac{B_2}{B_1}Z + \frac{1}{B_1}}{Z^2 - A_1Z - A_2}\right] \qquad \text{(F-12)}$$

By comparing F-12 with equation F-8, the values of the feed-forward and feedback coefficients shown in Figure F-1 can be determined from the Z-plane pole/zero locations:

$$B_1 = \frac{1}{|Z_o|^2} \qquad \text{(F-13)}$$

$$B_2 = -2B_1 Re(Z_o) \qquad \text{(F-14)}$$

$$C = \frac{K}{B_1} \qquad \text{(F-15)}$$

$$A_1 = 2Re(Z_p) \qquad \text{(F-16)}$$

$$A_2 = -|Z_p|^2. \qquad \text{(F-17)}$$

F.3 EXAMPLES OF DIGITAL FILTER DESIGNS

F.3-1 Low Pass Filter Design

This example will demonstrate the design of a 2-pole Tchebyscheff low-pass filter with a 0.5 dB pass-band ripple, a 3 dB cutoff frequency of 10 Hz, and a pass-band gain of 1. The sample rate is 100 Hz. The S-plane representation (from the table in Appendix E) of the low-pass filter is

$$G(S) = \frac{1}{(S+.5129091-j.7224659)(S+.5129091+j.7224659)}.$$

Substituting the above parameters into equations F-2 and F-4 the following results are obtained.

$$\Omega = \tan\left(\frac{f_d \times 180}{f_s}\right) = \tan 18^o = 0.3249197, \text{ and}$$

$$Z_p = \frac{\frac{1}{\Omega} + S}{\frac{1}{\Omega} - S} = .6475996 + j.3315148$$

$$Z^*_p = .6475996 - j.3315148.$$

The double zero at infinity is represented by

$$Z_{01} = Z_{02} = -1.0.$$

Thus, the transfer function in the Z-plane is

$$H(Z) = \frac{(Z + 1)(Z + 1)}{(Z-.6475996-j.3315148)(Z-.6475996+j.3315148)}.$$

From the roots in the Z-plane, the filter coefficients are determined using equations F-13 through F-17:

$$B_1 = \frac{1}{1^2} = 1$$

$$B_2 = -2(1)(-1) = 2$$

$$A_1 = 2(.6475996) = 1.295199$$

$$A_2 = -(.6475996^2 + .3315148^2) = -.5292872.$$

The impulse response of this filter is shown in Figure F.3.1-1.

F.3.2 High Pass Filter Design

This example problem demonstrates the design of a 2-pole Tchebyscheff high-pass filter with a 100 Hz stopband, 1-dB

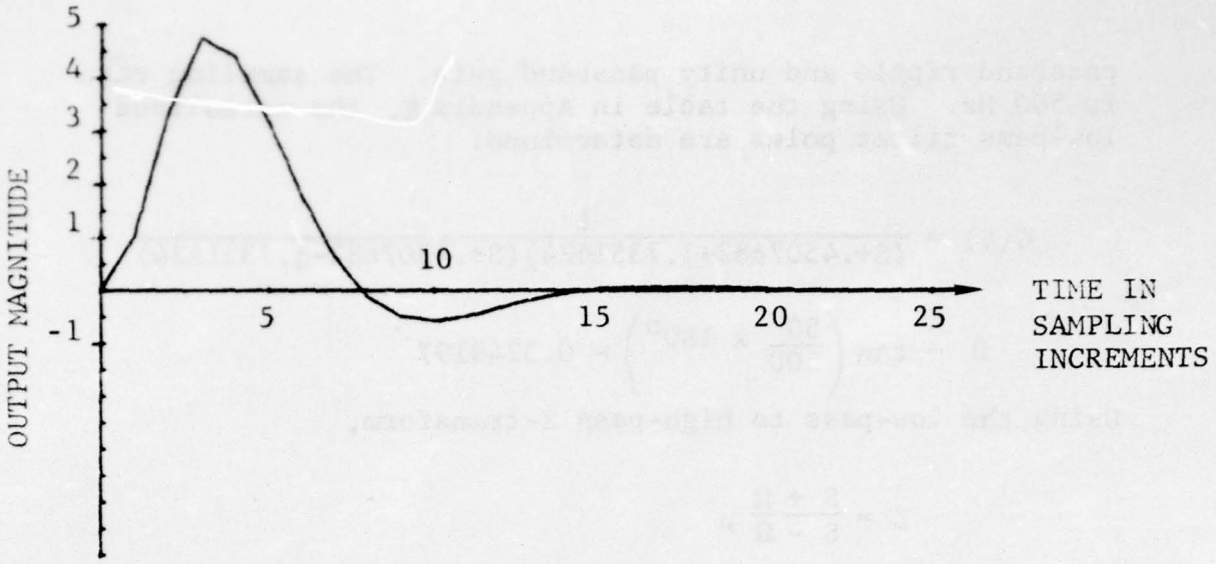


Figure F.3.1-1 IMPULSE RESPONSE - 0.5 dB TCHEBYSCHEFF LOWPASS FILTER

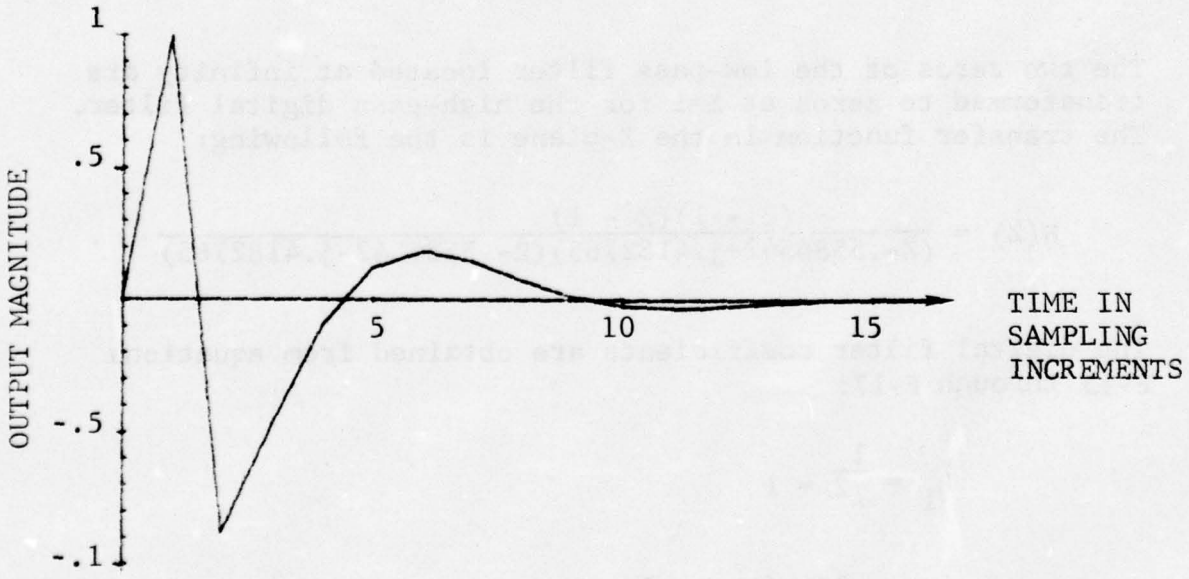


Figure F.3.2-1 IMPULSE RESPONSE - 1dB TCHEBYSCHEFF HIGHPASS FILTER

passband ripple and unity passband gain. The sampling rate is 500 Hz. Using the table in Appendix E, the normalized low-pass filter poles are determined:

$$G(S) = \frac{1}{(S+.4507682+j.7351424)(S+.4507682-j.7351424)}$$

$$\Omega = \tan\left(\frac{50}{500} \times 180^{o}\right) = 0.3249197$$

Using the low-pass to high-pass Z-transform,

$$Z = \frac{S + \Omega}{S - \Omega},$$

the roots of the denominator are determined to be

$$Z_p = .5586542 - j.4182765$$

$$Z_p^* = .5586542 + j.4182765.$$

The two zeros of the low-pass filter located at infinity are transformed to zeros at Z=1 for the high-pass digital filter. The transfer function in the Z-plane is the following:

$$H(Z) = \frac{(Z - 1)(Z - 1)}{(Z-.5586542+j.4182765)(Z-.5586542-j.4182765)}.$$

The digital filter coefficients are obtained from equations F-13 through F-17:

$$B_1 = \frac{1}{1^2} = 1$$

$$B_2 = -2(1)(1) = -2$$

$$C = 1$$

$$A_1 = 2(.5586542) = 1.117308$$

$$A_2 = -.4870497.$$

The impulse response of this filter is shown in Figure F.3.2-1.

F.3.3 Integrator Design

This example will demonstrate the design of a simple integrator with a 3 dB cutoff of one tenth the sampling rate and no Z-plane zeros. The S-plane representation of an integrator is the following

$$G(S) = \frac{1}{S + 1}$$

Substituting $S_P = -1$ and $\Omega = .3249197$ into equation F-4, the Z-plane pole is determined to be

$$Z = 0.5095254.$$

Since no Z-plane zeros are to be simulated, the Z-plane transfer function is

$$H(Z) = \frac{1}{Z-.5095254}.$$

The filter coefficients are the following:

$$B_1 = 0$$

$$B_2 = 0$$

$$C = 1$$

$$A_1 = 0.5095257$$

$$A_2 = 0.$$

The integrator impulse response is shown in Figure F.3.3-1.

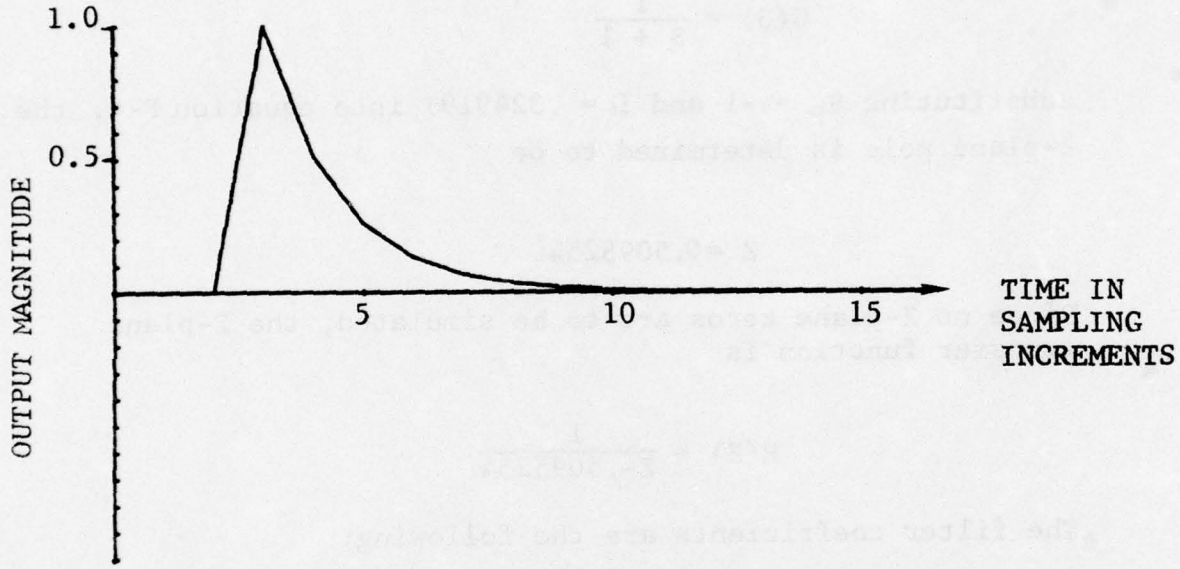


Figure F.3.3-1 IMPULSE RESPONSE - DIGITAL INTEGRATOR

APPENDIX G

COMPUTER PROGRAM

USED IN READING

RADAR CROSS SECTION TAPES

The documentation and listing of the computer program used in reading radar cross-section tapes is provided in this appendix.

SUBROUTINE DATAIN

1. MODULE IDENTIFICATION:

Name	Classification Code	Reference Number
DATAIN	Subroutine	Not user referenced

2. PURPOSE:

This subprogram is used to read Radar Cross Section data types generated by the General Dynamics/Ft. Worth RCS measurement range.

3. INPUT PARAMETERS:

None

4. CALLING SEQUENCES:

CALL DATAIN

Where: Data is passed via blank common.

5. RESTRICTIONS, REQUIREMENTS, AND MISCELLANEOUS DATA:

(a) Data read from the magnetic tape is placed in an array INDAT. In addition, a status word IERW is generated to indicate errors during read, if any. The specification in Fortran of the blank common area containing the above follows:

```
COMMON  INDAT(309), IDUM(3), IERW
```

IDUM(3) allocates storage for status words used by the subroutine.

(b) The character sets of the RCS tapes and the Honeywell computer differ in the representation of "=" and "+" signs. Therefore, this routine connects all occurrences of the above 2 characters into their appropriate representation in the Honeywell character set.

(c) The following GCOS Master Mode Entry (MME) routines are used in this subroutine:

GEINDS and GEROAD. Reference GCOS manual BR43C for an explanation of these routines.

(d) The file code allocated for the magnetic tape is 13. If a different file code is desired, the variable FA should be changed accordingly.

(e) This subroutine is structured to read records that are 1850 characters in length.

6. THEORY OF OPERATION

Upon entry to the subroutine, the necessary control words for GEINDS are set up and GEINDS is called. GEROAD is called to halt execution of the program until a record is read from the magnetic tape unit. Upon completion of the read, the status word returned by GEINDS is processed to determine if an error occurred and a status word, IERR, is generated for use by the calling program. The values of IERR are the following:

```
IERR = 0  No error detected
     = 1  End of file
     = 2  Longitudinal parity error detected
     = 3  Lateral parity error detected
     = 4  Error detected but not one of the above
     = 16 Blank tape on read
```

If the last word of the record is incomplete, the 10 is added to IERR. If the record is short by more than 1 word, then 20 is added to IERR.

```
10              SYMDEF  DATAIN
20              BLOCK                   BLANK COMMON
30      INDAT   BSS     309             BUFFER AREA
40      IPEF    BSS     1               CHAR/WORD XMITTAL STATUS
50      STATW   BSS     2               STATUS RETURN WORD
60      IERR    BSS     1               ERROR RETURN TO CALLING PROGRAM
70              USE     PREVIOUS
80      DATAIN  SAVE                    ENTRY POINT
90              LDA     DCW1
100             STA     DCW
110             LDA     =-2
120             STA     STATR
130             MME     GEINOS
140             RTD
150             ZERO    FA,DCW          FILE CODE WORD, DATA CONTROL WORD
160             ZERO    STATR           STATUS RETURN WORD
170             MME     GEROAD
180             LDAQ    STATR
190             STAQ    STATW
200             ANA     =0070000,DU
210             TZE     ERRF            NO ERRORS DETECTED BY TAPE CONTR
220             CMPA    =0040000,DU
230             TZE     EOF             END OF FILE DETECTED
240             CMPA    =0030000,DU
250             TZE     DALRT           DATA ALERT DETECTED
260             LDA     =4,DL
270             TRA     ERRF            UNKNOWN ERROR DETECTED
280     EOF     LDA     =1,DL           END OF FILE
290     EXIT    STA     IERR
300             TRA     RTURN
310     DALRT   LDA     STATR           DATA ALERT
320             ANA     =0007700,DU
330             CMPA    =0000200,DU     TEST FOR BLANK TAPE ON READ
340             TNZ     PCK
350             LDA     =16,DL
360             TRA     EXIT
370     PCK     ANA     =0001000,DU
380             TNZ     LATPC
390             LDA     =2,DL           LONGITUDINAL PARITY CHECK
400             TRA     ERRF
410     LATPC   LDA     =3,DL           LATERAL PARITY CHECK
420     ERRF    STA     IERR
430             ANQ     =0707777,DL     TEST RECORD LENGTH READ
440             STQ     IPEF            CHAR/WORD REMAINING TO XFER
450             TZE     TEST3
460             LLS     21              A=NUMBER OF CHAR IN LAST WORD
470             QRS     21              Q=NUMBER OF WORDS NOT XMITTED
480             CMPQ    =1,DL
490             TZE     SREC            If Q = 1; then ZERO = 1
500             TNC     CARCK           If Q < 1; then CARRY = Ø
510             LDQ     =20,DL          SHORT REC- MORE THAN 1 WORD DEFECTIVE
520             TRA     ENDE
530     CARCK   CMPA    =2,DL
540             LDA     IERR
550             TNC     SREC            If A < 2; then CARRY = Ø
560     TEST3   CMPA    =3,DL
570             TNZ     CHTL            If A ≠ 3; then ZERO = Ø
580             LDA     =0,DL
590             STA     IERR
600             TRA     CHTL
610     SREC    LDQ     =10,DL          SHORT RECORD-LAST WORD DEFECTIVE
```

```
620     ENDE    ASQ     IERR            COMBINE REC. LENG. TEST WITH IOC STAT.
630     CHTL    LDX0    =0,DU           CHARACTER TRANSLATE  + AND = SIGNS
640     NWORD   CMPX0   =309,DU         BEGINNING OF WORD LOOP
650             TZE     RTURN
660             LDA     INDAT,0         X0 IS INDEX REGISTER
670             LDX1    =6,DU
680             LDQ     =0777777777700
690     TESTC   NOP                     BEGINNING OF CHAR. LOOP
700             CMK     =013,DL         TEST RIGHT MOST CHAR FOR =
710             TZE     EQUAL
720             CMK     =032,DL         TEST RIGHT MOST CHAR FOR +
730             TZE     PLUS
740     ROTAT   ALR     6
750             SBX1    =1,DU
760             TNZ     TESTC           END OF CHAR. LOOP
770             STA     INDAT,0
780             ADX0    =1,DU
790             TRA     NWORD           END OF WORD LOOP
800     EQUAL   ERA     =0000066,DL     CORRECT = SIGN
810             TRA     ROTAT
820     PLUS    ERA     =0000052,DL     CORRECT + SIGN
830             TRA     ROTAT
840     RTURN   RETURN  DATAIN          RETURN TO CALLING PROGRAM
850     FA      BCI     1,000013
860     STATR   EBSS    2
870     DCW1    IOTD    INDAT,309       BUFFER ARRAY, NUMBER OF WORDS XMITTED
880     DCW     BSS     1
890             END
```

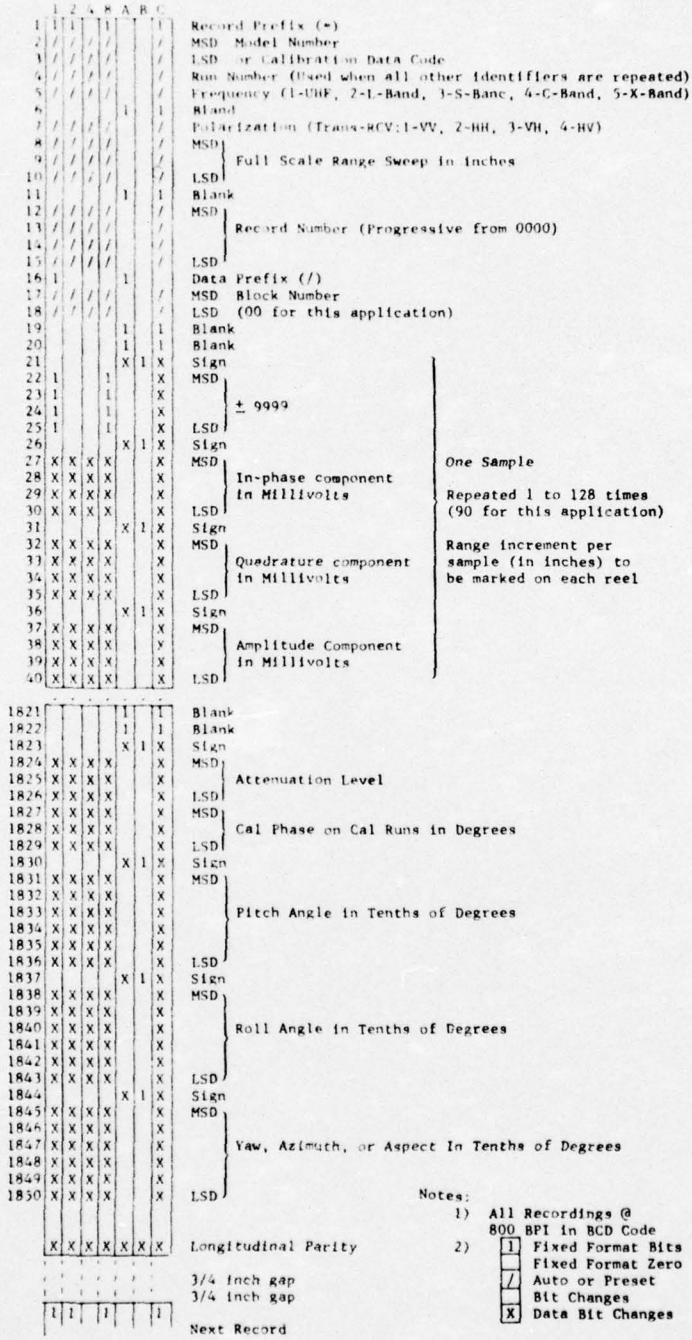


Fig. G-1 MAGNETIC TAPE FORMAT FOR SHORT PULSE DATA

APPENDIX H

COMPUTER PROGRAM FOR IMAGING COHERENT SHORT PULSE TARGET DATA

A printed-out listing of the computer program for imaging coherent short pulse target data is provided in this appendix. The computer program documentation together with a sample program is located in Volume I, Part 3, Section 8.17.

```
      C     FILE=IMAGP
              COMMON INDAT(309),IPEF,STATW(2),IERW
              CHARACTER INDAT1*480,INDAT2*480,INDAT3*480,INDAT4*414
              EQUIVALENCE  (INDAT(1),INDAT1),(INDAT(81),INDAT2),
             *          (INDAT(161),INDAT3),(INDAT(241),INDAT4)
              COMMON/BLOCK1/NPTSF,ITC, KAY, DELTAY, DATA(540)
              COMMON /BLOCK3/ THOLD, DRANG, IA, ITH, ICTRL
              COMMON/BLOCK9/ ICTROL ,RP,RN,SP,SN,ISET,NEND,THT
               COMMON/BLK1/BK1(500)
              COMMON/BLOCK11/XFI( 40,250), XFQ( 40,250), XFII( 64,250)
             1,ITI,TOI,DELI,DDI,XRI(128),ITQ,TOQ,DELQ,DDQ, XRQ(128)
              DIMENSION       IDATA(540)      ,IDATAI(540)    ,IDATAQ(540)    ,
             1IIA(2)          ,HEADR(3)       ,TRAILR(3)      ,ITHETA(2)      ,
             2THDES(40)       ,IFSKP(20)      ,SYSATT(4)      ,THMISS(30)     ,
             3TSWNDO(10)
              DIMENSION W(40),TGTID(10)
               CHARACTER TGTID
               EQUIVALENCE(M2,BK1(1))
               DATA PI,PI02,DTR,RTD/3.14159265,1.5707963,1.74533E-02,57.29578/
               DIMENSION CTABL(50)
               DATA CTABL/020,020,020,052,071,070,067,066,065,064,063,
             *         062,051,050,047,046,045,044,043,042,041,031,030,
             *         027,026,025,024,023,022,021,011,010,007,006,005,004,
             *         003,002,001,000,013,060,032,033/
               NAMELIST/CARD1/ TGTID,NBRTGT
               NAMELIST/CARD2/ KAY,DELTAY,NWNDOS
               NAMELIST/CARD3/ DRANG,CTGT,THINC,THOLD,FREQ
               NAMELIST/CARD4/ NFILES       ,NRPS,IR0,LAST,INOISE,NTH,M2,INCX
               NAMELIST/CARD5/ M2C,NTHO,ADELY
               NAMELIST/CARD6/ NFSKP,IFSKP
               NAMELIST/CARD8/ SYSATO,TSWNDO,IFSEP
            5  READ (5,CARD1)
               WRITE(6,2060) TGTID,NBRTGT
         2060  FORMAT(' TARGET =',10A6,' NBRTGT=',I5)
              READ  (5,CARD2)
               WRITE (6,CARD2)
              IF( NWNDOS .GT. 0 ) GO TO 6
              WRITE (6,1002)
         1002 FORMAT('  NWNDOS IS INCORRECT ' )
              CALL EXIT
            6 CONTINUE
               NWNDO = 1
               READ (5, CARD3)
               WRITE (6,CARD3)
      C
              ALMDA = 11.8/FREQ
              AK =(2*PI)/ALMDA
              AKR = AK*DRANG
              ACTGT = AK*CTGT
              THOLD1 = 20.0*ALOG10(THOLD)
              THTEST = 10.*THINC
              DTH = 0.5*THINC
              READ  (5,CARD4)
              WRITE (6,CARD4)
              ZNS = INOISE
              NPTS = LAST - IR0 + 1
              NPTSF = NPTS/INCX
              NTH1 = NTH + 1
              NTHN = 2**M2
```

```
600             ITI=NTHN
610             ITQ=NTHN
620           XNTH = NTH
630           NTH02= NTHN/2
640           NT02 = NTH/2
650           XNT2=(NTH - NT02)
660             AKW=PI02/XNT2
670     C
680     C     ******    WEIGHTING FUNCTION DEFINITION    ******
690     C
700             NT02X=NT02-1
710           DO 17 I=1,NTH
720             XTH = AKW*(NT02X-I)
730           CXTH = COS(XTH)
740             W(I)=0.08+0.92*CXTH*CXTH
750        17 CONTINUE
760             WRITE(6,7676) W
770      7676   FORMAT(' WEIGHTING FUNCT=',6F10.5,(/6F10.5))
780     C
790           WRITE (6, 7500) NPTS, NTH, ZNS, NPTSF
800      7500 FORMAT (' NPTS =',I5,/' NTH =',I5,/' ZNS =',F10.3,/
810          1       ' NPTSF =',I5  )
820     C
830           IF (NFILES .GT. 0  .AND.  NFILES .LT. 30)  GO TO 8
840           WRITE (6,1004)
850      1004 FORMAT (' NFILES INCORRECT ')
860           CALL EXIT
870         8 CONTINUE
880           NWDS = 90*NRPS
890           NBA = 1852
900           IF( NRPS .GT. 0 .AND.
910          1    NRPS .LE. 6       ) GO TO 10
920           WRITE (6,2020)
930      2020 FORMAT(' NRPS INCORRECT ' )
940           CALL EXIT
950        10 CONTINUE
960     C
970           READ (5,CARD5)
980           NPTSS = 2**M2C
990           WRITE(6,4001) NPTSS, NTHN, NTHQ, ADELY
1000     4001 FORMAT ( '0NUMBER OF POINTS TRANSFORMED IN TIME DOMAIN = ',I5,/
1010          1 ' NUMBER OF POINTS IN ANGLE TRANSFORM = ', I5,/ ' NUMBER OF THRES
1020          2HOLDS IN RTI = ', I5, / ' EXPECTED MAXIMUM AMPLITUDE OF IMAGE =
1030          3F8.4)
1040           XU = NPTSF+NTHN*KAY
1050           YL = 0.0
1060           YU = ADELY + NTHN*DELTAY
1070           READ  (5,CARD6)
1080           WRITE (6,2030)( IFSKP(J),J=1,NFSKP )
1090     2030 FORMAT(' FILES TO BE SKIPPED ',/' ',10(2X,I5) )
1100     C
1110     C
1120           JMISS = 0
1130           IFILE = 1
1140           ISKP  = 1
1150     C*****   *****   *****   *****
1160     C
1170           READ  (5,CARD8)
1180             SYSATT(1)=SYSATQ
1190             TSWNDO(1)=TSWNDQ
1200        31 CONTINUE
1210           ITHFG = 0
1220           THDES(1) = TSWNDO(NWNDO)
1230           DO 40 J=2,NTH
1240           THDES(J) = THDES(J-1) + THINC
1250        40 CONTINUE
```

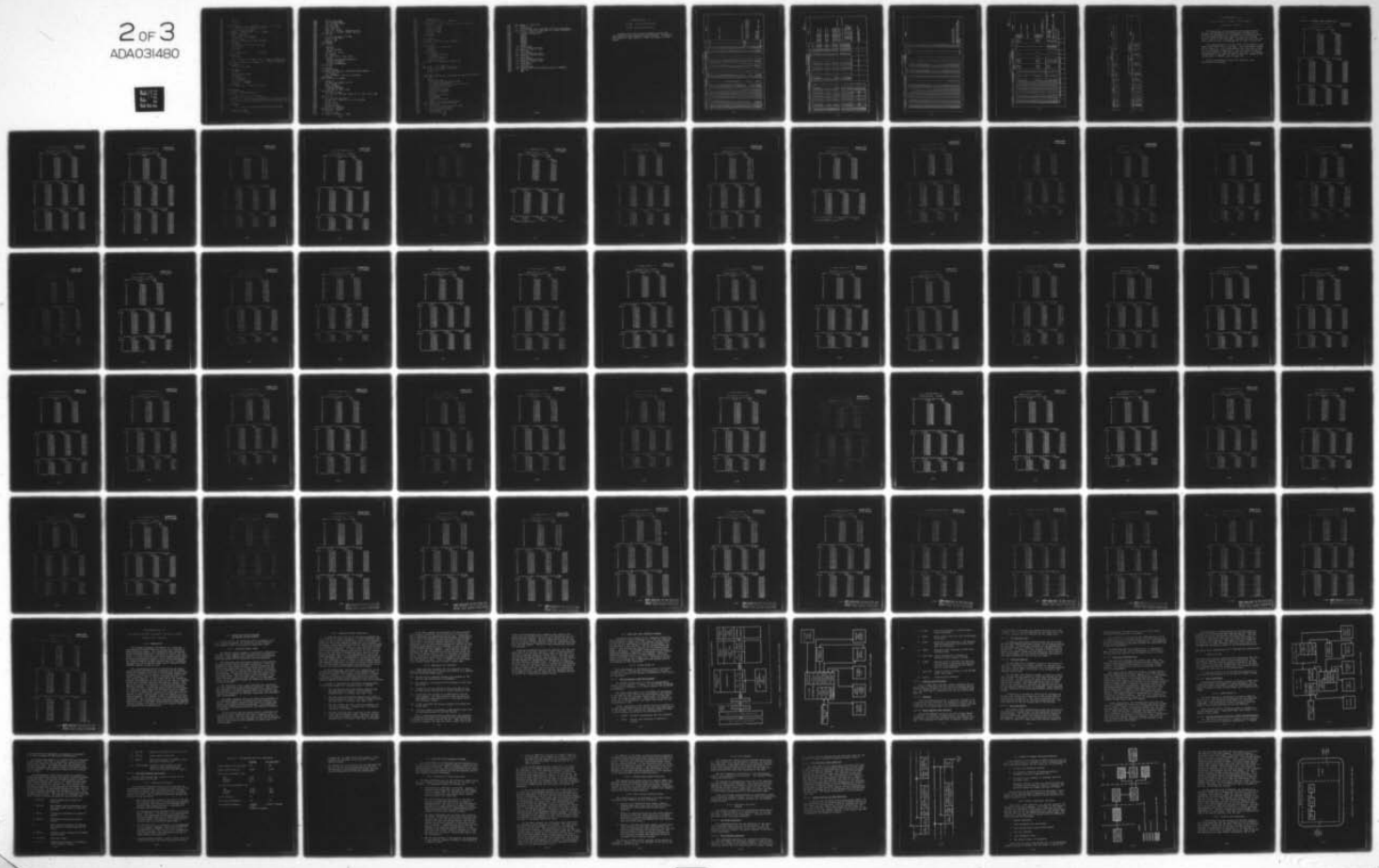
```
1260       245 THFIN = THDES(NTH)
1270           IF ( THFIN .GE. 360.0 ) ITHFG = 1
1280           WRITE (6,7610) NWNDO, SYSATT(1), THDES(1), THDES(NTH)
1290      7610 FORMAT(/'  ASPECT WINDOW NUMBER',I2,/' SYSATT =',F8.2,/
1300          1        '  WINDOW FROM ',F6.1,' TO ',F6.2,' DEGREES ' )
1310     C
1320           DO 45 J=1,NPTSF
1330           DO 45 JJ=1,NTH
1340           XFO (JJ,J) = 0.0
1350           XFI (JJ,J) = 0.0
1360        45 CONTINUE
1370     C
1380           ICTRL = 1
1390           IOFT = 1
1400           IOFASM = 1
1410           IMISS = 0
1420           NN  = 0
1430           ITH = 0
1440           ISPTST = 0
1450     C
1460       250 IF( IFILE .NE. IFSKP(ISKP) ) GO TO 270
1470           WRITE (6,6006)
1480      6006 FORMAT (' FILE TEST START ',)
1490       251   CONTINUE
1500             CALL DATAIN
1510             IF(IERW.EQ.0) GOTO 251
1520             CALL ERRPRC
1530             IF(IERW.EQ.1) GOTO 255
1540             GOTO 251
1550     C
1560       255 WRITE (6,7000) IFILE
1570      7000 FORMAT('  BYPASSED FILE ',I5 )
1580       265 IFILE = IFILE + 1
1590           IF( ISKP .GE. NFSKP ) GO TO 270
1600           ISKP = ISKP + 1
1610           GO TO 250
1620     C
1630       270  WRITE (6,6007)
1640       6007 FORMAT (' FILE TEST END - FILE PROCESS BEGIN ',I10)
1650     C
1660           IPASS = 1
1670           IOER = 0
1680           IGN = 0
1690           I9TST = 0
1700           IK = 0
1710       275 ITH = ITH + 1
1720     C
1730       278 ISRT = 1
1740           IHD =3
1750       280 CONTINUE
1760           CALL DATAIN
1770       292 ISTP = ISRT + 89
1780           IF( ISRT .EQ. 91 ) IHD = 1
1790           IF( ISRT .EQ. 181) IHD = 2
1800            IF(IERW.EQ.0.OR.IERW.EQ.10.OR.IERW.EQ.13) GOTO 52
1810            CALL ERRPRC
1820            IF(IERW.EQ.1) GOTO 310
1830            IF(IERW.GE.20) GOTO 70
1840            GOTO 315
1850     C
1860     C
1870       52  IF ( IHD .EQ. 3 ) GO TO 290
1880            ISRTE=ISRT+22
1890            DECODE(INDAT1,6710) (HEADR(J),J=1,3),
1900           * (IDATAI(J),IDATA0(J),J=ISRT,ISRTE)
1910       6710  FORMAT(3A6,2X,23(5X,2I5,5X))
```

```
1920            ISRTT=ISRTE+1
1930            ISRTE=ISRTE+24
1940            DECODE(INDAT2,6720) (IDATAI(J),IDATAQ(J),J=ISRTT,ISRTE)
1950     6720   FORMAT(24(5X,2I5,5X))
1960            ISRTT=ISRTE+1
1970            ISRTE=ISRTE+24
1980            DECODE(INDAT3,6720) (IDATAI(J),IDATAQ(J),J=ISRTT,ISRTE)
1990            ISRTT=ISRTE+1
2000            ISRTE=ISRTE+19
2010            DECODE(INDAT4,6730) (IDATAI(J),IDATAQ(J),J=ISRTT,ISRTE),
2020           *  IIA(IHD),(TRAILR(J),J=1,2),TRAILR(3),ITHETA(IHD)
2030     6730   FORMAT(19(5X,2I5,5X),3X,I3,2A6,A5,I7)
2040            GO TO 300
2050      290   CONTINUE
2060            IF (ISRT .EQ. 1 .AND. I9TST .EQ. 0) GO TO 79
2070            ISRTE=ISRT+22
2080            DECODE(INDAT1,6740) (IDATAI(J),IDATAQ(J),J=ISRT,ISRTE)
2090     6740   FORMAT(T21,23(5X,2I5,5X))
2100            ISRTT=ISRTE+1
2110            ISRTE=ISRTE+24
2120            DECODE(INDAT2,6720) (IDATAI(J),IDATAQ(J),J=ISRTT,ISRTE)
2130            ISRTT=ISRTE+1
2140            ISRTE=ISRTE+24
2150            DECODE(INDAT3,6720) (IDATAI(J),IDATAQ(J),J=ISRTT,ISRTE)
2160            ISRTT=ISRTE+1
2170            ISRTE=ISRTE+19
2180            DECODE(INDAT4,6720) (IDATAI(J),IDATAQ(J),J=ISRTT,ISRTE)
2190     C
2200       300  IF( ISTP .GE. NWDS ) GO TO 320
2210            ISRT = ISRT + 90
2220            IHD = 3
2230            GO TO 280
2240     C
2250     C
2260        70  CONTINUE
2270            NBR=FLD(21,15,IPEF)
2280            IF(NBR.GT.100) GOTO 72
2290        74  CONTINUE
2300            WRITE (6,5140) THDES(ITH), NBR
2310      5140  FORMAT (' 0SHORT RECORD FOUND - ANGLE = ',F7.1,5X,'NBR =',I6)
2320        76  CALL DATAIN
2330            IF(IERW.EQ.0 OR.IERW.EQ.10.OR.IERW.EQ.13) GOTO 79
2340            CALL ERRPRC
2350            IF(IERW.EQ.1) GOTO 310
2360            IF(IERW.GE.20) GOTO 74
2370            GOTO 315
2380     C
2390        72  WRITE (6,5180)
2400      5180  FORMAT (' SHORT RECORD ASSUMED TO BE GAP NOISE ')
2410            IGN = IGN + 1
2420            IF (IGN .GE. 3) CALL EXIT
2430            IHD = 3
2440            GO TO 280
2450     C
2460        79  CONTINUE
2470            DECODE(INDAT1,6012) I91,I92
2480      6012  FORMAT(T21,I5,T241,I5)
2490            IF ( I91 .LT. 0 .AND. I92 .LT. 0 ) GO TO 80
2500            IF (I9TST .EQ. 1) GO TO 76
2510            WRITE (6,9004)
2520      9004  FORMAT (' 0XXXXXXXXXX FIRST RECORD OF FILE BAD XXXXXXXXXX'//)
2530            GO TO 76
2540        80  ISRT = 1
2550            ISTP = 90
2560            IHD = 3
2570            I9TST = 1
```

```
2580            IGN = 0
2590            GO TO 52
2600      C
2610      C
2620        310 WRITE (6,7002) IFILE
2630       7002 FORMAT( / ' OFILL ASSUMED AT END OF FILE(',I2,')...REPLACE DATA ST
2640           1ARTING WITH RESTART ANGLE' )
2650            IF ( ( THFIN - THDES(ITH) ) .LE. THINC ) GO TO 96
2660            IOFT = 2
2670            IFILE = IFILE + 1
2680            I9TST = 0
2690            GO TO 278
2700         96 WRITE ( 6,5340 ) IFILE
2710       5340 FORMAT( '  FILE', I5, 'IS ASSUMED COMPLETE' )
2720            IOFASM = 2
2730            GO TO 400
2740      C
2750      C
2760        315 CONTINUE
2770            WRITE (6,7003) IFILE, THETA
2780       7003 FORMAT(' ERROR ATTEMPTING TO READ FILE(',I2,'), ASPECT=',F8.1 )
2790            IOER = IOER + 1
2800            IF (IOER .GE. 10)  CALL EXIT
2810            GO TO 76
2820      C
2830      C
2840       320  IGN = 0
2850            ABSITH = ITHETA(1) - ITHETA(2)
2860            IF ( ABS(ABSITH) .GT. THTEST )  GO TO 120
2870        119 THETA = ITHETA(1)/10.
2880            GO TO 130
2890        120 IF( ITH .EQ. 1 ) GO TO 119
2900            T1 = ITHETA(1)/10.
2910            T2 = ITHETA(2)/10.
2920            D1 = ABS( THETA - T1 )
2930            D2 = ABS( THETA - T2 )
2940            IF( D1 .LT. D2 ) GO TO 125
2950            THETA = T2
2960            GO TO 130
2970        125 THETA = T1
2980        130 CONTINUE
2990            IF ( THETA .LT. 300. .AND. ITHFG .EQ. 1 ) THETA = THETA + 360.0
3000      C
3010            ISPTST = ISPTST + 1
3020            IF ( ISPTST .NE. 2 )   GO TO 319
3030            IF( SYSATT(1).EQ.IIA(1)/10. .OR. SYSATT(1).EQ.IIA(2)/10. ) GO TO319
3040            WRITE (6,6015) SYSATT(1), IFILE
3050       6015 FORMAT ('0****** ATTENUATION LEVEL OF TAPE WAS NOT EQUAL TO',F8.2,
3060           1/         '          FILE NO. =',I5 )
3070            CALL EXIT
3080        319 CONTINUE
3090        317 CONTINUE
3100            GO TO (324,321),IOFT
3110        321 IOFT = 1
3120            IF( SYSATT(1).EQ.IIA(1)/10. .OR. SYSATT(1).EQ.IIA(2)/10. ) GO TO900
3130            WRITE (6,6015) SYSATT(1), IFILE
3140            CALL EXIT
3150        900 CONTINUE
3160            TEST = THETA
3170            J = 0
3180        322 J = J + 1
3190            IF( ABS( THDES(J) - ABS(THETA) ) .GT. DTH ) GO TO 322
3200            NN = NN + J - ITH
3210      C
3220        328 CONTINUE
3230      C
```

AD-A031 480 GENERAL DYNAMICS FORT WORTH TEX CONVAIR AEROSPACE DIV F/G 17/9
ENDO ATMOSPHERIC-EXO ATMOSPHERIC RADAR MODELING. APPENDICES, A---ETC(U)
JUN 76 R J HANCOCK, F H CLEVELAND F30602-73-C-0380
UNCLASSIFIED RADC-TR-76-186-VOL-4-PT-1 NL

2 OF 3
ADA031480



```
3240      C
3250            ITH= J
3260            IK = J
3270            GO TO 340
3280      C
3290        324 CONTINUE
3300        330 IF( ABS(THDES(ITH) - ABS(THETA) )  LE  DTH    ) GO TO 340
3310            IF ( THETA .LT. THDES(ITH) ) GO TO 335
3320            IF( IPASS .EQ. 1 ) GO TO 350
3330            WRITE (6,7010) THDES(ITH)
3340       7010 FORMAT(    ' ASPECT ANGLE ',F6.1,' MISSING ' )
3350            IMISS = IMISS + 1
3360            JMISS = JMISS + 1
3370            THMISS(JMISS) = THDES(ITH)
3380            IF( IMISS .LT. 5 ) GO TO 331
3390            WRITE (6,7011)
3400       7011 FORMAT(' TOO MANY ASPECT ANGLES MISSING ' )
3410            CALL EXIT
3420        331 CONTINUE
3430            IF( THDES(ITH) .GE. THFIN ) GO TO 400
3440            ITH = ITH + 1
3450            IK = IK + 1
3460            GO TO 330
3470      C
3480        335 IF ( IPASS .EQ. 2 )            GO TO 278
3490            GO TO 350
3500        340 IPASS = 2
3510            NN = NN + 1
3520      C
3530            WRITE (6,7020) NN,ITH,(HEADR(J),J=1,3),IIA(1),(TRAILR(J),J=1,2),
3540           1                                                TRAILR(3), ITHETA(1)
3550       7020 FORMAT ('0SWEEP(',I3,'), THDES(',I3,')  ',3A6,3X,I3,2A6,A5,I7 )
3560        150 CONTINUE
3570            IMISS = 0
3580            GO TO (278,355),IPASS
3590      C
3600        355 CONTINUE
3610            IK = IK + 1
3620            JF = 0
3630            DO 356 J=1,NPTS, INCX
3640            JF = JF + 1
3650            JJ = IR0 + J - 1
3660            XI = IDATAI(JJ)
3670            X0 = IDATA0(JJ)
3680            XFI(IK,JF) = XI/10000.
3690            XF0(IK,JF) = X0/10000.
3700        356 CONTINUE
3710            IF( THDES(ITH) .LT. THFIN ) GO TO 275
3720      C
3730      C
3740        400 CONTINUE
3750            WRITE (6,3000)
3760       3000 FORMAT (' FILE PROCESS END ')
3770      C
3780            IF (JMISS .EQ. 0)       GO TO 464
3790            WRITE(6,7600) (THMISS(J), J=1,JMISS)
3800       7600 FORMAT ('1'/' ********************************'/' ********************
3810           1**********'//'0THE FOLLOWING ASPECT ANGLES WERE MISSING'//,(F10.1
3820           2,','  ********************************'/' ************************
3830           3****'//)
3840        464 CONTINUE
3850      C
3860      C          *****  APPLY CORRECTION FACTOR AND WEIGHTING FUNCTION
3870      C
3880            DO 459  J=1, NPTSF
3890            CRR = AKR*J -ACTGT
```

```
3900          DO 554  IK= 1, NTH
3910          TH = (IK-NTO2)*THINC
3920          XCTH = CRA*COS( TH*DTR )
3930          XI = COS( XCTH)
3940          XQ =-SIN( XCTH)
3950          XFIX = XFI( IK,J)
3960          XFQX = XFQ( IK,J)
3970          XRI( IK) = ( XFIX*XI - XFQX*XQ )*W( IK)
3980          XRQ( IK) = ( XFIX*XQ + XFQX*XI )*W( IK)
3990      554 CONTINUE
4000      C
4010          IF ( NTH .GE. NTH1 ) GO TO 556
4020          DO 555 IK=NTH1,NTHN
4030          XRI(IK) = 0.0
4040          XRQ(IK) = 0.0
4050      555 CONTINUE
4060      556 CONTINUE
4070      C
4080           DELI=1.0
4090           DELQ=1.0
4100           CALL IFT(XRI,XRQ)
4110           IK=NTHN
4120          DO 493  IIK = 1,NTHN
4130          XI = XRI(IK)
4140          XQ = XRQ(IK)
4150          XA = SQRT( XI*XI + XQ*XQ )/XNTH
4160           IK=IK-1
4170           IADD=IFIX(40.0+20.0*ALOG10(XA)+0.5)
4180           IF(IADD.GT.43)IADD=44
4190           IF(IADD.LT.5)IADD=4
4200           XFII(IIK,J)=CTABL(IADD)
4210      493 CONTINUE
4220      C
4230      459 CONTINUE
4240          WRITE (6,7510)
4250     7510 FORMAT(1H1,'AMPLITUDE  (TRANSFORM IN THETA DOMAIN) ' )
4260          DO 460 J=1,NPTSF
4270          RJ = J*DRANG
4280          WRITE (6,7520)RJ, (XFII(IK,J),IK=1,NTHN)
4290      460 CONTINUE
4300     7520  FORMAT(1H ,F8.5,100R1)
4310      C
4320          JMISS = 0
4330          IF( NWNDO  EQ. NWNDOS ) GO TO 5
4340          NWNDO = NWNDO + 1
4350          READ  (5,CARD8)
4360           SYSATT(1)=SYSATQ
4370           TSWNDO(NWNDO)=TSWNDQ
4380          GO TO (599, 31, 410) , IFSEP
4390      599 CONTINUE
4400          TEST = TSWNDO(NWNDO)
4410          IF ( TEST .LE. 300.  AND. ITHFG .EQ. 1 )  TEST = TEST + 360
4420          J = 0
4430      600 J = J + 1
4440          IF (J .GT. NTH) GO TO 606
4450          IF( ABS(TEST - THDES(J)) .GT. 0.1 ) GO TO 600
4460          IK = 0
4470          DO 602 L=J,NTH
4480          IK = IK + 1
4490          DO 601 LL=1,NPTSF
4500          XFQ(IK,LL) = XFQ(L,LL)
4510      601 XFI(IK,LL) = XFI(L,LL)
4520      602 THDES(IK) = THDES(L)
4530          LL = IK + 1
4540          DO 603 L=LL,NTH
4550      603 THDES(L) = THDES(L-1) + THINC
```

```
4560            ITHFG = 0
4570            DO 604 L= 1,NTH
4580            IF ( THDES(L) .GE. 360. ) ITHFG = 1
4590          604 CONTINUE
4600            WRITE (6,7610) NWNDO, SYSATT(1), THDES(1), THDES(NTH)
4610            ITH = IK
4620            THFIN = THDES(NTH)
4630            DO 605 J= 1, NPTSF
4640            DO 605 JJ= LL,NTH
4650            XFO (JJ,J) = 0.0
4660            XFI (JJ,J) = 0.0
4670          605 CONTINUE
4680            GO TO 275
4690        C
4700          606 CONTINUE
4710            WRITE (6,7006)
4720         7006 FORMAT ( ' NO MATCH FOUND FOR ANGLE ' )
4730             CALL EXIT
4740        C
4750          410 CONTINUE
4760            IF (IOFASM .EQ. 1) GO TO 415
4770            IOFASM = 1
4780            GO TO 411
4790          415 CONTINUE
4800             CALL DATAIN
4810             IF(IERW.EQ.0) GOTO 410
4820             CALL ERRPRC
4830             IF(IERW.EQ.1) GOTO 411
4840             WRITE(6,7031)IFILE
4850             GOTO 410
4860         7031 FORMAT (' READING TO EOF IN FILE ',I5)
4870        C
4880        C
4890         411  WRITE (6,7004) IFILE
4900         7004 FORMAT(  ' COMPLETED FILE(',I2,') ' )
4910            IF( IFILE .EQ. NFILES ) GO TO 610
4920            IFILE = IFILE + 1
4930            GO TO 31
4940        C
4950          610 WRITE (6,7620)
4960         7620 FORMAT(' FILE FOR NEXT WINDOW DOES NOT EXIST ON THIS TAPE ')
4970            GO TO 5
4980            END
4990             SUBROUTINE ERRPRC
5000             COMMON INDAT(309),IPEF,STATW(2),IERW
5010             DATA IBLBL/0000000002020/
5020             DATA IREAD,IERR1,IERR2,IERR3,IERR4/0,0,0,0,0/
5030             DATA IERR5,IERR6/0,0/,IW/6/
5040             IREAD=IREAD+1
5050             IF(IERW.EQ.0) GOTO 800
5060             ISTAT=FLD(0,12,STATW(1))
5070             IREC=FLD(0,18,INDAT(3))
5080             IERR=IERW
5090             IF(IERR.LT.10) GOTO 30
5100             IERR=IERR-10
5110             IERR1=IERR1+1
5120             IF(IERR.LT.10) GOTO 20
5130             IERR=5
5140          20    WRITE(IW,1001) IERW,IPEF,IREC,ISTAT
5150         1001 FORMAT(1H ,I2,1X,O6,1X,R3,1X,O4)
5160          30    IERR=IERR+1
5170             GOTO(800,550,600,650,700,750,850),IERR
5180          900   ITEST=FLD(12,12,INDAT(304))
5190             IF(ITEST.EQ.IBLBL) RETURN
5200             IERR6=IERR6+1
5210             WRITE(IW,1003) ITEST
```

```
5220      1003 FORMAT(1H ,'ITEST=',04)
5230           RETURN
5240      550  IREAD=IREAD-1
5250           WRITE(IW,1008) IREAD,IERR1,IERR2,IERR3,IERR4,IERR5,IERR6
5260      1008 FORMAT(1H ,'END OF FILE DETECTED',I4,' RECORDS PROCESSED BY ',
5270          * ' ERRPRC   ERR=',6(I3,1X))
5280           IF(IERR.EQ.7) CALL EXIT
5290           IREAD=0
5300           IERR1=0
5310           IERR2=0
5320           IERR3=0
5330           IERR4=0
5340           IERR5=0
5350           IERR6=0
5360           RETURN
5370       600 IERR2=IERR2+1
5380           WRITE(IW,1004) IREC,ISTAT
5390      1004 FORMAT(1H ,'LONPCK-',R3,04)
5400           GO TO 800
5410      650  IERR3=IERR3+1
5420           WRITE(IW,1005) IREC,ISTAT
5430      1005 FORMAT(1H ,'LATPCK-',R3,04)
5440           GO TO 800
5450       700 IERR4=IERR4+1
5460           WRITE(IW,1006) IREC,ISTAT
5470      1006 FORMAT(1H ,'UNKERR-',R3,04)
5480           GO TO 800
5490      750  IERR5=IERR5+1
5000           GOTO 800
5510       850 WRITE(IW,1015)
5520      1015 FORMAT(' BLANK TAPE ON READ=THIS JOB WILL TERMINATE')
5530           GOTO 550
5540           END
```

APPENDIX I

TSAR SIMULATION

RUN CATALOGUES

Listings of all the computer program runs for the TSAR Simulation are provided in this Appendix. A detailed explanation of these tables is found in Volume 3 of this series.

TABLE I-1 - TSARJB RUN CATALOG

IDENTIFIERS		SYSTEM			CONTROL GEN.		ARRAY AND SIGNAL PROCESSING								COMMENTS
SNUMB	DATE	N2	FS	SIMBW	THETAS	NBPSCG	THETAS THETAR	NBPSR	ASTRT	ASTOP	MODTSR	REC PROCSS	FNL	DX	
6669T	11-20	14	1.0	0.1	0.955	3	0.955	4	-5.0	10.0	1	NO	NO	0.299793	
2790T	11-27	14	1.0	0.1	0.955	3	0.955	4	-5.0	30.0	1	NO	NO	↑	
2837T	11-27	14	1.0	0.1	10.0	3	10.0	4	-5.0	30.0	1	NO	NO		
3901T	11-27	14	1.0	0.1	20.0	3	20.0	4	5.0	40.0	1	NO	NO		
1848T	11-29	14	1.0	0.1	0.955	3	0.955	4	-5.0	30.0	1	NO	NO		
7771T	11-30	14	1.0	0.1	0.955	3	0.955	4	-5.0	30.0	1	NO	NO		
8601T	11-30	14	1.0	0.1	20.0	3	20.0	4	5.0	40.0	1	NO	NO		
2017T	12-03	14	1.0	0.1	40.0	3	60.0	4	25.0	40.0	1	NO	NO		
8878T	12-04	14	1.0	0.1	0.955	3	0.955	4	-5.0	30.0	1	NO	NO		NPULS = 3 in CGEN
1794T	12-13	14	1.0	0.1	0.955	3	0.955	4	-5.0	5.0	1	NO	NO		
2872T	12-13	14	1.0	0.1	0.955	3	0.955	4	-5.0	5.0	2	YES	NO		
3566T	12-13	14	1.0	0.1	0.955	3	0.955	4	-5.0	10.0	3	YES	NO		
2827T	1-07	14	1.0	0.1	0.955	10	0.955	4	-5.0	10.0	7	NO	NO		
4099T	1-07	14	1.0	0.1	0.955	10	0.955	4	-5.0	10.0	1	NO	NO		
7809T	1-08	14	1.0	0.1	0.955	10	0.955	4	-5.0	10.0	7	NO	NO		
3667T	1-09	14	1.0	0.1	0.955	10	0.955	4	-5.0	10.0	7	NO	NO		
8371T	1-10	14	1.0	0.1	0.950	10	0.95	4	0.0	2.0	7	NO	NO		
8812T	1-10	14	1.0	0.1	13.70	10	13.70	4	5.0	25.0	2	YES	NO		
8967T	1-10	14	1.0	0.1	13.70	10	13.70	4	5.0	25.0	7	NO	NO		
2252T	1-11	14	1.0	0.1	13.70	10	13.70	4	5.0	25.0	2	YES	NO		
3901T	1-11	14	1.0	0.1	7.18	10	7.18	4	0.0	35.0	2	YES	NO		
8414T	1-14	14	1.0	0.1	7.18	10	7.18	4	0.0	35.0	1	NO	NO		
3594T	1-15	14	1.0	0.1	0.950	10	0.95	4	0.0	35.0	2	YES	NO		
6700T	1-16	14	1.0	0.1	0.950	10	0.95	4	0.0	35.0	1	NO	NO		
7688T	1-16	14	0.5	0.1	0.950	10	0.95	4	0.0	15.0	1	NO	NO		
2728T	1-17	14	0.5	0.1	0.950	3	0.95	4	0.0	15.0	1	NO	NO		
3805T	1-17	14	1.0	0.1	0.950	3	0.95	4	-5.0	35.0	1	NO	NO		
7487T	1-18	14	0.5	0.06	0.950	3	0.95	4	-5.0	20.0	1	NO	NO		Cassette Data Unplotted
2749T	1-21	14	0.5	0.06	0.950	3	0.95	4	-5.0	25.0	1	NO	YES	0.299793	
8602T	1-22	14	1.0	0.10	0.950	3	0.95	4	-5.0	35.0	1	NO	NO	0.344590	
8902T	1-22	14	1.0	0.10	2.0	10	2.0	10	-5.0	35.0	1	NO	NO	0.299793	Contains Scan of CGEN Spectrum
8902T	1-22	14	1.0	0.10	3.0	10	3.0	10	-5.0	35.0	1	NO	NO	↑	Contains Scan of CGEN Spectrum
8902T	1-22	14	1.0	0.10	4.0	10	4.0	10	-5.0	35.0	1	NO	NO		Contains Scan of CGEN Spectrum
3751T	1-21	14	1.0	0.10	-61.04	10	-61.04	4	-70.0	-30.0	1	NO	NO		
4171T		14	1.0	0.10	2.00	3	2.0	4	-5.0	35.0	1	NO	YES		
4171T	↑	14	1.0	0.10	3.00	3	3.0	4	↑	↑	1	NO	YES		
4171T	↓	14	1.0	0.10	4.00	3	4.0	4			1	NO	YES		
4171T	1-23	14	1.0	0.10	5.00	3	5.0	4	-5.0	35.0	1	NO	YES		
2141T	2-05	14	0.5	0.10	13.70	10	13.70	4	12.0	15.0	7	NO	NO		NCGPLS = 140
8246T	2-06	14	0.5	0.10	13.70	10	13.70	4	12.0	15.0	7	NO	NO		NCGPLS = 240
3765T	2-19	14	0.5	0.10	0.950	3	0.950	4	-5.0	15.0	3	YES	YES		Data Punched by SNUMB = 2689T
7542T	3-06	14	0.5	0.10	0.950	10	0.950	4	-5.0	20.0	1	NO	YES		
7596T	5-06	14	1.0	0.10	0.950	3	0.950	4	-5.0	35.0	2	YES	YES	0.299793	

TABLE I-1 - TSARJB RUN CATALOG

IDENTIFIERS		SYSTEM			CONTROL GEN.		ARRAY AND SIGNAL PROCESSING								COMMENTS
SNUMB	DATE	N2	FS	SIMBW	THETAS	NBPSCG	THETAS THETAR	NBPSR	ASTRT	ASTOP	MODTSR	REC PROCSS	FNL	DX	
7610T	5-06	14	1.0	0.10	0.950	3	0.950	4	-5.0	35.0	2	YES	NO	0.299793	
2646T	5-07	14	1.0	0.10	0.950	10	0.950	4	-5.0	35.0	1	NO	YES	↑	
2661T	5-07	14	1.0	0.10	0.950	10	0.950	4	-5.0	35.0	2	YES	YES	↓	
3590T	5-07	15	1.0	0.10	0.950	3	0.950	4	-5.0	35.0	3	YES	YES		
7468T	5-08	15	1.0	0.10	0.950	3	0.950	4	-5.0	35.0	3	YES	YES	0.299793	NCGPLS = 300
8522T	5-08	14	1.0	0.10	0.950	3	0.950	4	-5.0	35.0	1	NO	YES	2.398342	TSAR SUBARRAY PATTERN
8712T	5-08	15	1.0	0.10	0.950	3	0.950	4	-5.0	35.0	3	YES	NO	0.299793	NCGPLS = 300
3575T	5-09	14	1.0	0.10	1.0	3	1.0	4	-5.0	35.0	1	NO	YES	2.398342	TSAR SUBARRAY PATTERN
3575T	↑	↑	↑	↑	2.0	↑	2.0	4	↑	↑	1	NO	YES	↑	
3575T					3.0		3.0	4			1	NO	YES		
3575T	↓	↓	↓	↓	4.0	↓	4.0	4	↓	↓	1	NO	YES	↓	
3575T	5-09	14	1.0	0.10	5.0	3	5.0	4	-5.0	35.0	1	NO	YES	2.398342	TSAR SUBARRAY PATTERN
8415T	5-14	15	1.0	0.10	0.950	3	0.950	4	-5.0	35.0	1	NO	YES	0.299793	NCGPLS = 300
4288T	5-09	14	1.0	0.10	1.0	3	1.0	4	-5.0	40.0	3	NO	YES	2.398342	TSAR SUBARRAY PATTERN
4288T	↑	↑	↑	↑	2.0	↑	2.0	4	↑	↑	3	NO	YES	↑	
4288T					3.0		3.0	4			3	NO	YES		
4288T	↓	↓	↓	↓	4.0	↓	4.0	4	↓	↓	3	NO	YES	↓	
4288T	5-09	14	1.0	0.10	5.0	3	5.0	4	-5.0	40.0	3	NO	YES	2.398342	TSAR SUBARRAY PATTERN
2726T	5-09	14	1.0	0.10	0.950	3	0.950	4	-5.0	35.0	3	NO	YES	2.398342	TSAR SUBARRAY PATTERN
7478T	5-16	14	1.0	0.10	0.950	10	0.950	10	-5.0	35.0	1	NO	YES	2.398342	TSAR SUBARRAY PATTERN
7478T	5-16	14	1.0	0.10	0.950	10	0.950	10	-5.0	35.0	3	NO	YES	2.398342	TSAR SUBARRAY PATTERN
2688T	5-17	15	1.0	0.10	13.70	3	13.70	4	10.0	17.5	6	NO	YES	0.299793	Punched by 7437T 05/17/74 same Job Run as 7474T 05/28/74
3404T	5-29	15	1.0	0.10	0.950	3	0.950	--	-5.0	35.0	3	YES	YES	2.398342	TSAR SUBARRAY PATTERN
3732T	5-29	15	1.0	0.10	1.00	3	1.0	4	-5.0	35.0	3	YES	YES	0.299793	
3732T	5-29	15	1.0	0.10	2.00	3	2.0	4	-5.0	35.0	3	YES	YES	0.299793	Bad Data (Receiver Proc. Set for 1.0°)
7546T	5-30	15	1.0	0.10	0.950	10	0.950	4	-5.0	35.0	3	YES	YES	0.299793	
7462T	06-17	15	1.0	0.10	2.0	3	2.00	4	-5.0	35.0	3	YES	YES	0.299793	Rerun of 3732T Pass 2
8462T	06-17	15	1.0	0.10	0.950	10	0.950	4	-5.0	35.0	3	NO	YES	2.398342	NCGPLS = 300 Punched by
8462T	06-17	14	1.0	0.10	2.00	10	2.00	4	-5.0	35.0	3	NO	YES	2.398342	NCGPLS = 140 2682T
8430T	06-19	15	1.0	0.10	0.950	4	0.950	4	-5.0	35.0	3	NO	YES	0.299793	NCGPLS = 300 Punched by
8430T	06-19	15	1.0	0.10	0.950	6	0.950	4	-5.0	35.0	3	NO	YES	0.299793	NCGPLS = 300 2666T
2730T	07-22	14	2.0	0.080	10.0	10	----------		NOT APPLICABLE			----------		----------	Control Generator Output
2730T	↑	↑	↑	↑	20.0	↑									Spectrum Scan Only
2730T					30.0										
2730T					40.0										
2730T	↓	↓	↓	↓	60.0	↓									
2730T	07-22	14	2.0	0.080	80.00	10									
3389T	07-22	15	1.0	0.100	10.0	10	----------		NOT APPLICABLE			----------		----------	Control Generator Output
3389T	↑	↑	↑	↑	20.0	↑									Spectrum Scan Only
3389T					30.0										
3389T					40.0										
3389T	↓	↓	↓	↓	60.0	↓									
3389T	07-22	15	1.0	0.100	80.0	10									

TABLE I-2 - TSARTM RUN CATALOG

IDENTIFIERS		SYSTEM			CONTROL GENERATOR			ANTENNA ARRAY						COMMENTS
SNUMB	DATE	N2	FS	SIMBW	THETAS	NBPSCG	NCGPLS	THETAS THETAR	ANGLE	NBPSR	MODTSR	DX	FNL	
6678T	12-14	12	0.5		0.955	3	62	0.955	0.955	4		0.299793	NO	
3109T	12-17	12	0.5		0.955	3	62	0.955	0.955	4			NO	
7456T	12-18	12	0.5	0.1	0.955	3	62	0.955	0.955	4			NO	
8611T	12-18	12	0.5	0.1	0.955	3	62	0.955	0.955	4			NO	
1935T	12-19	12	0.5	0.1	0.955	3	62	0.955	0.955	4			NO	
3665T	12-19	13	0.5	0.1	0.955	3	62	0.955	0.955	4			NO	
6707T	12-20	13	0.5	0.1	0.955	3	62	0.955	7.65	4			NO	
8697T	12-20	13	0.5	0.2	0.955	3	62	0.955	0.955	4	1		NO	
1836T	1-07	13	0.5	0.2	0.955	3	62	0.955	0.955	4	1		NO	
3930T	1-07	13	0.5	0.2	0.955	3	62	0.955	0.955	4	1		NO	
6693T	1-08	13	0.5	0.2	0.955	3	62	0.955	0.955	4	1		NO	
8676T	1-08	13	0.5	0.2	0.955	3	62	0.955	0.955	4	1		NO	
8762T	1-08	13	0.5	0.2	0.955	3	62	0.955	0.955	4	1		NO	
8843T	1-08	13	0.5	0.2	0.955	3	62	0.955	0.955	4	1		NO	
8946T	1-08	13	0.5	0.2	0.955	3	62	0.955	0.955	4	1		NO	
3652T	1-09	13	0.5	0.2	0.955	3	62	0.955	0.955	4	1		NO	
7768T	1-10	13	0.5	0.2	0.955	3	62	0.955	0.955	4	1		NO	
8483T	1-10	13	0.5	0.2	0.955	3	62	0.955	0.955	4	1		NO	
8863T	1-10	13	0.5	0.2	13.7	3	62	13.7	13.7	4	1		NO	
3726T	1-11	13	0.5	0.2	7.18	3	62	7.18	7.18	4	1		NO	
6713T	1-16	13	0.5	0.2	0.95	3	62	0.95	0.95	4	1		NO	
8388T	1-18	13	0.5	0.06	0.95	3	62	0.95	0.95	4	1		NO	
3845T	1-21	13	0.5	0.06	0.95	3	62	0.95	0.95	4	1		YES	
8376T	1-22	13	0.5	0.10	2.0	10	62	2.0	2.0	10	1		YES	
8700T	1-24	13	0.5	0.10	0.950	3	62	0.95	0.95	4	1		YES	
8700T	1-24	13	0.5	0.10	-61.0	3	62	0.95	-61.0	4	1		YES	
2713T	1-25	13	0.5	0.10	7.18	3	62	7.18	7.18	4	1		YES	
2713T	1-25	13	0.5	0.10	-61.0	3	62	-61.0	-61.0	4	1		YES	
8004T	2-06	13	0.5	0.10	7.18	3	62	7.18	7.18	4	1		YES	
3133T	2-07	13	0.5	0.10	0.950	3	62	0.950	7.70	4	1		YES	
3133T	2-07	13	0.5	0.10	0.400	3	62	0.400	0.400	4	1		YES	
3133T	2-07	13	0.5	0.10	0.440	3	62	0.440	0.440	4	1		YES	
7691T	2-08	13	0.5	0.10	13.70	10	62	13.70	13.70	4	7		NO	
7457T	2-12	13	0.5	0.10	13.70	10	62	13.70	13.70	4	7		NO	
8712T	2-12	13	0.5	0.10	13.70	10	62	13.70	13.70	4	7		NO	
6704T	2-14	13	0.5	0.10	13.70	10	62	13.70	13.80	4	7		NO	
6704T	2-14	13	0.5	0.10	13.70	10	62	13.70	13.60	4	7		NO	(Error in Second Pass)
2644T	2-19	13	0.5	0.10	13.70	10	62	13.70	13.80	4	7		NO	MONOTM (Rerun of 6704T)
2644T	2-19	13	0.5	0.10	13.70	10	62	13.70	13.60	4	7		NO	
2665T	2-19	13	0.5	0.10	0.44	3	62	0.44	0.44	4	1		YES	(Rerun of plots 9 & 10 of 3133T
1844T	3-05	13	0.5	0.10	13.70	10	62	13.70	13.80	4	7		YES	MONOTM (Error in Correcting TSARY)
1844T	3-05	13	0.5	0.10	13.70	10	62	13.70	13.60	4	7		YES	[NOTE 1] (Error in Correcting TSARY)
1871T	3-05	13	0.5	0.10	13.70	10	62	13.70	13.70	4	7	0.299793	YES	MONOTM

TABLE I-2 -TSARTM RUN CATALOG

IDENTIFIERS		SYSTEM			CONTROL GENERATOR			ANTENNA ARRAY						COMMENTS
SNUMB	DATE	N2	FS	SIMBW	THETAS	NBPSCG	NCGPLS	THETAS THETAR	ANGLE	NBPSR	MODTSR	DX	FNL	
7502T	3-06	13	0.5	0.10	13.70	10	62	13.70	13.80	4	7	0.299793	YES	MONOTM
7502T	3-06	13	0.5	0.10	13.70	10	62	13.70	13.60	4	7		YES	MONOTM
1825T	3-07	13	0.5	0.10	13.70	10	62	13.70	13.80	4	7		NO	MONOTM
1825T	3-07	13	0.5	0.10	13.70	10	62	13.70	13.60	4	7		NO	MONOTM
2723T	3-07	13	0.5	0.10	0.950	3	62							CJOB2 Control Generator
2723T	3-07	13	0.5	0.10	0.40	3	62							Spectra
2723T	3-07	13	0.5	0.10	0.44	3	62							
2723T	3-07	13	0.5	0.10	0.950	10	62							
2723T	3-07	13	0.5	0.10	0.40	10	62							
4156T	3-07	13	0.5	0.10	1.0	3	62							CJOB2 Control Generator
4156T	3-07	13	0.5	0.10	2.0	3	62							Spectra
4156T	3-07	13	0.5	0.10	3.0	3	62							
4156T	3-07	13	0.5	0.10	4.0	3	62							
4156T	3-07	13	0.5	0.10	5.0	3	62							
4156T	3-07	13	0.5	0.10	6.0	3	62							
4156T	3-07	13	0.5	0.10	0.44	10	62							Rerun as 7550T 03/19/74
7477T	3-08	13	0.5	0.10	13.70	10	62	13.70	13.90	4	7		YES	MONOTM
7477T	3-08	13	0.5	0.10	13.70	10	62	13.70	13.50	4	7		YES	MONOTM
6643T	3-11	13	0.5	0.10	13.70	10	62	13.70	13.75	4	7		YES	MONOTM
6643T	3-11	13	0.5	0.10	13.70	10	62	13.70	13.65	4	7		YES	MONOTM
8457T	3-06	13	0.5	0.10	0.950	3	62							CJOB2
8457T	3-06	13	0.5	0.10	0.40	3	62							Rerun of CGGN output of
8457T	3-06	13	0.5	0.10	0.44	3	62							3133T with new phase detector
8457T	3-06	13	0.5	0.10	0.44	3	62							
8933T	4-02	Rerun of 8497T with New Phase Detector Mechanization												
8386T	5-02	13	0.5	0.10	13.70	10	62	13.70	13.70	4	7		NO	Rerun of 8712 with Proper Time Reference
8404T	5-02	13	0.5	0.10	13.70	10	62	13.70	13.70	4	7	0.299793	YES	Same as 1871; but Plotted More Data
3887T	05-09	13	0.5	0.10	0.950	3	62	0.950	7.70	4	1	2.39834	YES	TSAR SUBARRAY
7583T	07-15	13	0.5	0.10	0.950	10	62	-	31.15	-	1	2.39834	NO	TSAR SUBARRAY
7583T	07-15	13	0.5	0.10	0.950	10	8	-	31.15	-	1	2.39834	NO	
3604T	07-16	13	0.5	0.10	0.950	10	62	-	31.15	-	1	2.39834	NO	Rerun of 7583T with different plot param. punched by 3695T 7664T
3604T	07-16	13	0.5	0.10	0.950	10	8	-	31.15	-	1	2.39834	NO	
2808T	07-16	13	0.5	0.10	0.950	10	62	-	15.50	-	1	2.39834	NO	Punched by 7638T
2808T	07-16	13	0.5	0.10	0.950	10	8	-	15.50	-	1	2.39834	NO	

NOTE 1: In runs made prior to this point - the array impulse response was referenced to the First Radiating Element. Subsequent runs are referenced to the center of the antenna array.

TABLE I-3 - FSANTM RUN CATALOG

IDENTIFIERS		SYSTEM				CGENCW			ARRAY				COMMENTS
SNUMB	DATE	N2	FS	SIMBW	RFFO	THETAS	SPW	NSUBP	THETAS	NBPSR	MODTSR	FNL	
8812T	01-14	13	0.5	0.2	0.5	0.955	3000.	1	0.950	4	1	NO	Error in Input Data, Run Aborted
1888T	01-15	13	0.5	0.2	0.5	0.955	3000.	1	0.950	4	1	NO	

TABLE I-4 - FSANT RUN CATALOG

IDENTIFIERS		SYSTEM				CGENCW			ARRAY			COMPUTATION LIMITS		COMMENTS
SNUMB	DATE	N2	FS	SIMBW	RFFO	THETAS	SPW	NSUBP	THETAS	NBPSR	FNL	ASTRT	ASTOP	
7608T	01-14	14	1.0	0.1	0.5	0.950	4620.	1	0.950	4	NO	-5.0	15.0	Job Aborted
8765T	01-14	14	1.0	0.1	0.5	0.950	4620.	1	0.950	4	NO	-5.0	15.0	
8516T	01-16	14	1.0	0.1	0.5	10.0	4620.	1	10.0	4	NO	0.0	30.0	
3667T	01-23	14	1.0	0.1	0.5	0.0	4620.	1	14.5	10	NO	-5.0	35.0	
8486T	01-24	14	1.0	0.05	0.5	3.5	4620.	1	18.15	4	NO	-5.0	50.0	

APPENDIX J

ANTENNA LOBE SCANNER

OUTPUT DATA

The output data of the Antenna Lobe Scanner computer program TSAR Simulation runs catalogued in Appendix I is provided in this appendix. The relative gain and direction of the antenna pattern side lobes are given for various absolute gains of the main lobe. Listings are given for side lobes, both in order of magnitude and in order of position.

Each page represents one run, which is identified in the upper right hand corner of the page. The snub number (SNUMB) and the data (e.g. 1-22) correspond to the first two columns of the catalogues in Appendix I. The pass number refers to the entry number for that snub number and date. For example, "SNUMB=8902T, 1-22, Pass #2" shown on page J-3 refers to the second entry of "8902T, 1-22" on page I-2.

Plots illustrated in Volume III use these same identification markings.

Table J-1 ANTENNA LOBE SCANNER OUTPUT

SNUMB=8902T
1-22,Pass#1

• • • • ANTENNA LOBE SCANNER • • • •

THE MAIN LOBE GAIN IS 47.8218226

LOCATION AND RELATIVE GAIN OF HIGHEST 20 SIDE LOBES

RANK	REL. GAIN (DB)	ANGLE (DEG)
MAIN	0.0	2.0000000
1	-13.0361264	1.3500000
2	-13.0291300	2.6500000
3	-17.6041594	0.9000000
4	-17.6058664	3.1000000
5	-20.6241126	3.5500000
6	-20.6423063	0.4500000
7	-22.9092073	-0.0000000
8	-22.9405689	4.0000000
9	-24.7926216	-0.4500000
10	-24.7931080	4.4500000
11	-26.3630013	4.9000000
12	-26.3916907	-0.9000000
13	-27.7626324	-1.3500000
14	-27.7920585	5.3500000
15	-28.9807363	-1.8000000
16	-29.0261512	5.8000000
17	-30.0771031	-2.2500000
18	-30.1311698	6.2499999
19	-31.1202965	6.6999999
20	-31.1836705	-2.7000000

MAIN LOBE NULL AND FIRST 20 SIDE-LOBES TO RIGHT OF (ABOVE) MAIN LOBE

RANK	REL. GAIN (DB)	TRUE ANGLE (DEG)	REL. ANGLE (DEG)
MAIN LOBE	•• NULL ••	2.4500000	
1	-13.0291300	2.6500000	0.6500000
2	-17.6058664	3.1000000	1.1000000
3	-20.6241126	3.5500000	1.5500000
4	-22.9405689	4.0000000	2.0000000
5	-24.7931080	4.4500000	2.4500000
6	-26.3630013	4.9000000	2.9000000
7	-27.7920585	5.3500000	3.3500000
8	-29.0261512	5.8000000	3.8000000
9	-30.1311698	6.2499999	4.2500000
10	-31.1202965	6.6999999	4.7000000
11	-32.0837040	7.1500000	5.1500000
12	-32.9214311	7.6000000	5.6000000
13	-33.7679534	8.0500000	6.0500000
14	-34.4775119	8.5000000	6.5000001
15	-35.0804257	8.9499999	6.9500000
16	-35.6195593	9.4000000	7.4000000
17	-36.1239052	9.9000000	7.9000000
18	-36.5594797	10.3499999	8.3499999
19	-36.9003377	10.8499999	8.8499999
20	-37.2910542	11.3000000	9.3000000

MAIN LOBE NULL AND FIRST 20 SIDE-LOBES TO LEFT OF (BELOW) MAIN LOBE

RANK	REL. GAIN (DB)	TRUE ANGLE (DEG)	REL. ANGLE (DEG)
MAIN LOBE	•• NULL ••	1.5500000	
1	-13.0361264	1.3500000	-0.6500000
2	-17.6041594	0.9000000	-1.1000000
3	-20.6423063	0.4500000	-1.5500000
4	-22.9092073	-0.0000000	-2.0000000
5	-24.7926216	-0.4500000	-2.4500000
6	-26.3916907	-0.9000000	-2.9000000
7	-27.7626324	-1.3500000	-3.3500000
8	-28.9807363	-1.8000000	-3.8000000
9	-30.0771031	-2.2500000	-4.2499999
10	-31.1836705	-2.7000000	-4.7000000
11	-32.0971685	-3.1500000	-5.1500000
12	-32.9307470	-3.6000000	-5.6000000
13	-33.6758013	-4.0500000	-6.0500000
14	-34.4081964	-4.5000000	-6.4999999
15	-35.0868244	-4.9500000	-6.9499999

NO FURTHER SIDE LOBES ON THIS SIDE

SNUMB=8902T
1-22, Pass#2

• • • • ANTENNA LOBE SCANNER • • • •

THE MAIN LOBE GAIN IS 47.8174233

LOCATION AND RELATIVE GAIN OF HIGHEST 20 SIDE LOBES

RANK	REL. GAIN (DB)	ANGLE (DEG)
MAIN	0.0	3.0000000
1	-12.9490614	2.3500000
2	-12.9884882	3.6500000
3	-17.5583038	1.9000000
4	-17.6226730	4.1000000
5	-20.6065463	1.4500000
6	-20.6421523	4.5500000
7	-22.9054661	1.0000000
8	-22.9148593	4.9999999
9	-24.7624536	0.5500000
10	-24.7761693	5.4500000
11	-26.3087053	0.1000000
12	-26.3753686	5.9000000
13	-27.6935997	-0.3500000
14	-27.7253823	6.3500000
15	-28.9198308	-0.8000000
16	-28.9506540	6.8000000
17	-30.0383978	7.2499999
18	-30.1132083	-1.2500000
19	-31.0468960	7.6999999
20	-31.1525440	-1.7000000

MAIN LOBE NULL AND FIRST 20 SIDE-LOBES TO RIGHT OF (ABOVE) MAIN LOBE

RANK	REL. GAIN (DB)	TRUE ANGLE (DEG)	REL. ANGLE (DEG)
MAIN LOBE	•• NULL ••	3.4500000	
1	-12.9884882	3.6500000	0.6500000
2	-17.6226730	4.1000000	1.1000000
3	-20.6421523	4.5500000	1.5500000
4	-22.9148593	4.9999999	2.0000000
5	-24.7761693	5.4500000	2.4500000
6	-26.3753686	5.9000000	2.9000000
7	-27.7253823	6.3500000	3.3500000
8	-28.9506540	6.8000000	3.8000000
9	-30.0383978	7.2499999	4.2500000
10	-31.0468960	7.6999999	4.7000000
11	-32.0782876	8.1500000	5.1500000
12	-32.9089999	8.5999999	5.6000000
13	-33.7006454	9.0500000	6.0500000
14	-34.5619659	9.4499999	6.4500000
15	-34.4971533	9.5500000	6.5500000
16	-35.0920672	10.0000000	7.0000001
17	-35.6189294	10.4499999	7.4500000
18	-36.1427851	10.9000000	7.9000000
19	-36.5689917	11.4499999	8.4499999
20	-36.9418898	11.9000000	8.9000000

MAIN LOBE NULL AND FIRST 20 SIDE-LOBES TO LEFT OF (BELOW) MAIN LOBE

RANK	REL. GAIN (DB)	TRUE ANGLE (DEG)	REL. ANGLE (DEG)
MAIN LOBE	•• NULL ••	2.5500000	
1	-12.9490614	2.3500000	-0.6500000
2	-17.5583038	1.9000000	-1.1000000
3	-20.6065483	1.4500000	-1.5500000
4	-22.9054661	1.0000000	-2.0000000
5	-24.7624536	0.5500000	-2.4500000
6	-26.3087053	0.1000000	-2.9000000
7	-27.6935997	-0.3500000	-3.3500000
8	-28.9198308	-0.8000000	-3.8000000
9	-30.1132083	-1.2500000	-4.2500000
10	-31.1525440	-1.7000000	-4.7000000
11	-32.0609813	-2.1500000	-5.1500000
12	-32.9059062	-2.6000000	-5.6000000
13	-33.6953616	-3.0500000	-6.0500000
14	-34.4029884	-3.5000000	-6.4999999
15	-35.0466642	-3.9500000	-6.9500000
16	-35.7416568	-4.4000000	-7.3999999
17	-36.2872109	-4.9000000	-7.8999999

NO FURTHER SIDE LOBES ON THIS SIDE

SNUMB=8902T
1-22,Pass#3

• • • • ANTENNA LOBE SCANNER • • • •

THE MAIN LOBE GAIN IS 47.8195219

LOCATION AND RELATIVE GAIN OF HIGHEST 20 SIDE LOBES

RANK	REL. GAIN (DB)	ANGLE (DEG)
MAIN	0.0	4.0000000
1	-12.9868002	3.3500000
2	-13.0212927	4.6500000
3	-17.5588055	2.9000000
4	-17.5960703	5.1000000
5	-20.5808043	2.4500000
6	-20.6431212	5.5500000
7	-22.8563833	2.0000000
8	-22.9253621	5.9999999
9	-24.7384033	1.5500000
10	-24.7682619	6.4499999
11	-26.2969308	1.1000000
12	-26.3245201	6.9000000
13	-27.7062082	7.3500000
14	-27.7198877	0.6500000
15	-28.9366486	7.8000000
16	-28.9457912	0.2000000
17	-30.0452714	-0.2500000
18	-30.0719309	8.2500000
19	-31.0531001	-0.7000000
20	-31.0940461	8.6999999

MAIN LOBE NULL AND FIRST 20 SIDE-LOBES TO RIGHT OF (ABOVE) MAIN LOBE

RANK	REL. GAIN (DB)	TRUE ANGLE (DEG)	REL. ANGLE (DEG)
MAIN LOBE	•• NULL ••	4.4500000	
1	-13.0212927	4.6500000	0.6500000
2	-17.5960703	5.1000000	1.1000000
3	-20.6431212	5.5500000	1.5500000
4	-22.9255621	5.9999999	2.0000000
5	-24.7682619	6.4499999	2.4500000
6	-26.3245201	6.9000000	2.9000000
7	-27.7062082	7.3500000	3.3500000
8	-28.9366486	7.8000000	3.8000000
9	-30.0719309	8.2500000	4.2500001
10	-31.0940461	8.6999999	4.7000000
11	-32.1467724	9.1999999	5.2000000
12	-32.9469175	9.6500000	5.6500000
13	-33.7265306	10.0999999	6.1000000
14	-34.4429808	10.5500000	6.5500000
15	-35.4728622	10.8000000	6.8000000
16	-35.0970087	11.0000000	7.0000001
17	-35.6719203	11.4499999	7.4500000
18	-36.4121618	11.8499999	7.8500000
19	-36.2605467	11.9499999	7.9500000
20	-36.6432958	12.4499999	8.4499999

MAIN LOBE NULL AND FIRST 20 SIDE-LOBES TO LEFT OF (BELOW) MAIN LOBE

RANK	REL. GAIN (DB)	TRUE ANGLE (DEG)	REL. ANGLE (DEG)
MAIN LOBE	•• NULL ••	3.5000000	
1	-12.9868002	3.3500000	-0.6500000
2	-17.5588055	2.9000000	-1.1000000
3	-20.5808043	2.4500000	-1.5500000
4	-22.8563833	2.0000000	-2.0000000
5	-24.7384033	1.5500000	-2.4500000
6	-26.2969308	1.1000000	-2.9000000
7	-27.7198877	0.6500000	-3.3500000
8	-28.9457912	0.2000000	-3.8000000
9	-30.0452714	-0.2500000	-4.2500000
10	-31.0531001	-0.7000000	-4.7000000
11	-31.9357543	-1.1500000	-5.1500000
12	-32.9167657	-1.6000000	-5.6000000
13	-33.6852956	-2.0500000	-6.0500000
14	-34.4168429	-2.5000000	-6.4999999
15	-35.0967226	-2.9000000	-6.9000000
16	-35.8800583	-3.2500000	-7.2499999
17	-35.7286062	-3.3500000	-7.3500000
18	-35.8278966	-3.4500000	-7.4500000
19	-36.3107982	-3.9500000	-7.9500000
20	-36.6988506	-4.4000000	-8.4000000

SNUMB=8602T
1-22,Pass#1

• • • • AZIMUTH CUT SCANNER • • • •

THE PEAK LEVEL IS AT AZ= 47.5000000

LOCATION AND RELATIVE LEVEL OF LOWEST 20 SIDE LOBES

	REL. GAIN (DB)	ANGLE (DEG)
0	0.0	0.6500000
1	-12.9554124	1.6000000
2	-17.4519773	0.3500000
3	-17.4264431	-2.0500000
4	-17.4417278	2.5.0000
5	-17.4511971	-0.1500000
6	-17.4373429	3.95.000
7	-17.[illegible]	2.9[illegible]
8	-17.[illegible]	-0.[illegible]
9	-17.[illegible]	2.950[illegible]
10	-17.[illegible]	-1.050[illegible]
11	-17.[illegible]	-1.450[illegible]
12	-17.[illegible]	3.40[illegible]
13	-17.[illegible]	6.9999999
14	-17.[illegible]	15.2499999
15	-17.[illegible]	4.700[illegible]
16	-17.[illegible]	-5.000[illegible]
17	-17.[illegible]	-2.80[illegible]
18	-17.[illegible]	6.60[illegible]
19	-17.[illegible]	-4.250[illegible]
20	-17.[illegible]	9.1999999

LOCATION AND RELATIVE LEVEL OF FIRST 20 SIDE-LOBES TO RIGHT OF (ABOVE) MAIN LOBE

	REL. GAIN (DB)	TRUE ANGLE (DEG)	REL. ANGLE (DEG)
**	0.0 **	1.4[illegible]	
1	-12.9554124	1.6[illegible]	0.6500000
2	-17.4519773	2.050[illegible]	1.1000000
3	-17.[illegible]	2.9[illegible]	1.5500000
4	-17.[illegible]	2.95[illegible]	2.0000000
5	-17.[illegible]	3.4[illegible]	2.4500000
6	-17.[illegible]	3.95[illegible]	3.0000000
7	-17.[illegible]	4.7[illegible]	3.7500000
8	-17.[illegible]	5.249999[illegible]	4.3000000
9	-17.[illegible]	5.6 [illegible]	4.6500000
10	-17.[illegible]	6.2[illegible]	5.2500000
11	-17.[illegible]	6.999999[illegible]	6.0500000
12	-17.[illegible]	7.749999[illegible]	6.8000000
13	-17.[illegible]	8.3[illegible]	7.3500000
14	-17.[illegible]	9.199999[illegible]	8.2500000
15	-17.[illegible]	10.[illegible]	9.1000000
16	-17.[illegible]	10.[illegible]	9.5500001
17	-17.[illegible]	11.[illegible]	10.0500001
18	-17.[illegible]	11.449999[illegible]	10.5500000
19	-17.[illegible]	12.3[illegible]	11.3500000
20	-17.[illegible]	13.249999[illegible]	12.3000000

LOCATION AND RELATIVE LEVEL OF FIRST 20 SIDE-LOBES TO LEFT OF (BELOW) MAIN LOBE

	REL. GAIN (DB)	TRUE ANGLE (DEG)	REL. ANGLE (DEG)
**	0.0 **	0.5[illegible]	
1	-12.9554124	0.3[illegible]	-0.6500000
2	-17.4519773	-0.1[illegible]	-1.1000000
3	-17.[illegible]	-0.6[illegible]	-1.5500000
4	-17.[illegible]	-1.0[illegible]	-2.0000000
5	-17.[illegible]	-1.4[illegible]	-2.4000000
6	-17.[illegible]	-2.0[illegible]	-3.0000000
7	-17.[illegible]	-2.6[illegible]	-3.7500000
8	-17.[illegible]	-3.3[illegible]	-4.2500000
9	-17.[illegible]	-3.7[illegible]	-4.6500000
10	-17.[illegible]	-4.2500000	-5.2000000

SNUMB=3805T
1-17,Pass#1

• • • • ANTENNA LOBE SCANNER • • • •

THE MAIN LOBE GAIN IS 47.5484395

LOCATION AND RELATIVE GAIN OF HIGHEST 20 SIDE LOBES

RANK	REL. GAIN (DB)	ANGLE (DEG)
MAIN	0.0	0.9500000
1	-12.7927752	0.3000000
2	-12.9332924	1.6000000
3	-16.9841747	-0.1500000
4	-17.3261299	2.0500000
5	-20.2226043	-0.6000000
6	-20.2434125	2.5000000
7	-20.6797380	7.6999999
8	-22.4736376	-1.0500000
9	-22.4934831	2.9500000
10	-23.3212700	8.5500000
11	-24.0559015	-1.5000000
12	-24.3340569	3.4000000
13	-25.8522973	3.8500000
14	-25.9318614	-1.9500000
15	-26.7540183	4.3000000
16	-26.8770161	15.4000000
17	-27.1035166	-2.4000000
18	-27.9378462	-2.8500000
19	-28.0519300	6.9499999
20	-28.4699359	4.7499999

MAIN LOBE NULL AND FIRST 20 SIDE-LOBES TO RIGHT OF (ABOVE) MAIN LOBE

RANK	REL. GAIN (DB)	TRUE ANGLE (DEG)	REL. ANGLE (DEG)
MAIN LOBE	•• NULL ••	1.4000000	
1	-12.9332924	1.6000000	0.6500000
2	-17.3261299	2.0500000	1.1000000
3	-20.2434125	2.5000000	1.5500000
4	-22.4934831	2.9500000	2.0000000
5	-24.3340569	3.4000000	2.4500000
6	-25.8522973	3.8500000	2.9000000
7	-26.7540183	4.3000000	3.3500000
8	-28.4699359	4.7499999	3.8000000
9	-28.5022697	5.2000000	4.2500000
10	-29.7632928	5.7000000	4.7500000
11	-29.9847836	6.1000000	5.1500000
12	-28.0519300	6.9499999	5.9999999
13	-20.6797380	7.6999999	6.7499999
14	-23.3212700	8.5500000	7.6000000
15	-31.0151644	9.3499999	8.4000000
16	-33.7391386	10.2500000	9.3000001
17	-34.5896802	10.5999999	9.6500000
18	-35.3428349	11.0999999	10.1500000
19	-35.3768578	11.5500000	10.6000000
20	-35.8257980	12.0500000	11.1000000

MAIN LOBE NULL AND FIRST 20 SIDE-LOBES TO LEFT OF (BELOW) MAIN LOBE

RANK	REL. GAIN (DB)	TRUE ANGLE (DEG)	REL. ANGLE (DEG)
MAIN LOBE	•• NULL ••	0.5000000	
1	-12.7927752	0.3000000	-0.6500000
2	-16.9841747	-0.1500000	-1.1000000
3	-20.2226043	-0.6000000	-1.5500000
4	-22.4736376	-1.0500000	-2.0000000
5	-24.0559015	-1.5000000	-2.4500000
6	-25.9318614	-1.9500000	-2.9000000
7	-27.1035166	-2.4000000	-3.3500000
8	-27.9378462	-2.8500000	-3.8000000
9	-29.0754943	-3.2500000	-4.2000000
10	-29.6678810	-3.8000000	-4.7500000
11	-29.5699596	-4.1500000	-5.1000000

NO FURTHER SIDE LOBES ON THIS SIDE

SNUMB=3751T
1-21, Pass#1

SNUMB=2728T
1-17,Pass#1

* * * * ANTENNA LOBE SCANNER * * * *

THE MAIN LOBE GAIN IS 47.5448976

LOCATION AND RELATIVE GAIN OF HIGHEST 20 SIDE LOBES

RANK	REL. GAIN (DB)	ANGLE (DEG)
MAIN	0.0	0.9500000
1	-12.7514744	0.3000000
2	-12.9102144	1.6000000
3	-17.3078966	2.0500000
4	-18.3569708	0.
5	-20.2256680	2.5000000
6	-20.6951466	7.7000000
7	-22.5026350	2.9500000
8	-23.3354301	8.5500000
9	-24.3316240	3.4000000
10	-25.8279252	3.8500000
11	-26.7601342	4.3000000
12	-28.0585971	6.9500000
13	-28.4907932	4.7500000
14	-28.5093365	5.2000000
15	-29.4220567	14.9499999
16	-29.5899444	6.1000000
17	-29.7486134	5.7000000
18	-31.0382600	9.3500000
19	-33.6370106	14.3499999
20	-33.7795157	10.2500000

MAIN LOBE NULL AND FIRST 20 SIDE-LOBES TO RIGHT OF (ABOVE) MAIN LOBE

RANK	REL. GAIN (DB)	TRUE ANGLE (DEG)	REL. ANGLE (DEG)
MAIN LOBE	** NULL **	1.4000000	
1	-12.9102144	1.6000000	0.6500000
2	-17.3078966	2.0500000	1.1000000
3	-20.2256680	2.5000000	1.5500000
4	-22.5026350	2.9500000	2.0000000
5	-24.3316240	3.4000000	2.4500000
6	-25.8279252	3.8500000	2.9000000
7	-26.7601342	4.3000000	3.3500000
8	-28.4907932	4.7500000	3.8000000
9	-28.5093365	5.2000000	4.2500000
10	-29.7486134	5.7000000	4.7500000
11	-29.5899444	6.1000000	5.1500000
12	-28.0585971	6.9500000	6.0000000
13	-20.6951466	7.7000000	6.7500000
14	-23.3354301	8.5500000	7.6000000
15	-31.0382600	9.3500000	8.4000000
16	-33.7795157	10.2500000	9.3000000
17	-34.5925670	10.5999999	9.6499999
18	-35.3558760	11.0999999	10.1499999
19	-35.3683176	11.5999999	10.6499999
20	-35.8125710	12.0500000	11.0999999

MAIN LOBE NULL AND FIRST 20 SIDE-LOBES TO LEFT OF (BELOW) MAIN LOBE

RANK	REL. GAIN (DB)	TRUE ANGLE (DEG)	REL. ANGLE (DEG)
MAIN LOBE	** NULL **	0.5000000	
1	-12.7514744	0.3000000	-0.6500000

NO FURTHER SIDE LOBES ON THIS SIDE

SNUMB=7487T
1-18, Pass#1

• • • • ANTENNA LOBE SCANNER • • • •

THE MAIN LOBE GAIN IS 47.549 172

LOCATION AND RELATIVE GAIN OF HIGHEST 20 SIDE LOBES

RANK	REL. GAIN (DB)	ANGLE (DEG)
MAIN	0.0	0.9500000
1	-12.7512550	0.3000000
2	-12.9100733	1.6000000
3	-14.9828091	-0.1500000
4	-17.3075469	2.0500000
5	-20.2284180	-0.6000000
6	-20.2253729	2.5000000
7	-20.6938152	7.6999999
8	-22.4672194	-1.0500000
9	-22.5019064	2.9500000
10	-23.3357840	8.5500000
11	-24.0471101	-1.5000000
12	-24.3307977	3.4000000
13	-25.8273849	3.8500000
14	-25.8999967	-1.9500000
15	-26.7597222	4.3000000
16	-26.9238539	15.4000000
17	-27.0971394	-2.4000000
18	-27.9544759	-2.8500000
19	-28.0613669	6.9499999
20	-28.4913135	4.7499999

MAIN LOBE NULL AND FIRST 20 SIDE-LOBES TO RIGHT OF (ABOVE) MAIN LOBE

RANK	REL. GAIN (DB)	TRUE ANGLE (DEG)	REL. ANGLE (DEG)
MAIN LOBE	** NULL **	1.4500000	
1	-12.9100733	1.6000000	0.1500000
2	-17.3075469	2.0500000	1.1000000
3	-20.2253729	2.5000000	1.5500000
4	-22.5019064	2.9500000	2.0000000
5	-24.3307977	3.4000000	2.4500000
6	-25.8273849	3.8500000	2.9000000
7	-26.7597222	4.3000000	3.3500000
8	-26.4913135	4.7499999	3.8000000
9	-28.5044745	5.2000000	4.2500000
10	-29.7503491	5.7000000	4.7500000
11	-29.5912223	6.1000000	5.1500000
12	-28.0415648	6.9499999	5.9999999
13	-20.6938152	7.6999999	6.7499999
14	-23.3357840	8.5500000	7.6000000
15	-31.0501652	9.3499999	8.4000000
16	-33.7816975	10.2500000	9.3000001
17	-34.6937085	10.5999999	9.6500000
18	-35.3574694	11.0999999	10.1500000
19	-35.3686609	11.5999999	10.6500000
20	-35.8127046	12.0500000	11.1000000

MAIN LOBE NULL AND FIRST 20 SIDE-LOBES TO LEFT OF (BELOW) MAIN LOBE

RANK	REL. GAIN (DB)	TRUE ANGLE (DEG)	REL. ANGLE (DEG)
MAIN LOBE	** NULL **	0.5000000	
1	-12.7512550	0.3000000	-0.6500000
2	-14.9828091	-0.1500000	-1.1000000
3	-20.2254380	-0.6000000	-1.5500000
4	-24.4672194	-1.0500000	-2.0000000
5	-24.0471101	-1.5000000	-2.4500000
6	-25.8998967	-1.9500000	-2.9000000
7	-27.0971394	-2.4000000	-3.3500000
8	-27.9544759	-2.8500000	-3.8000000
9	-29.1159067	-3.2500000	-4.2000000
10	-29.5494110	-3.8000000	-4.7500000
11	-29.5458985	-4.1500000	-5.1000000

NO FURTHER SIDE LOBES ON THIS SIDE

SNUMB=7610T
5-06,Pass#1

* * * * ANTENNA LOBE SCANNER * * * *

THE MAIN LOBE GAIN IS 47.919 869

LOCATION AND RELATIVE GAIN OF HIGHEST 20 SIDE LOBES

RANK	REL. GAIN (DB)	ANGLE (DEG)
MAIN	0.0	0.9500000
1	-13.439959[illegible]	1.6000000
2	-13.53511[illegible]	0.3000000
3	-18.067[illegible]	2.0500000
4	-18.176[illegible]	-0.1500000
5	-21.134[illegible]	2.5000000
6	-21.27[illegible]	-0.6000000
7	-23.392[illegible]	2.9500000
8	-23.631[illegible]	-1.0500000
9	-25.27[illegible]	3.4000000
10	-25.585[illegible]	-1.5000000
11	-26.903[illegible]	3.8500000
12	-26.92[illegible]	15.4000000
13	-27.274[illegible]	-1.9500000
14	-28.26[illegible]	4.3000000
15	-28.69[illegible]	-2.4000000
16	-29.500[illegible]	4.7499999
17	-29.76[illegible]	14.9499999
18	-29.99[illegible]	-2.8500000
19	-30.655[illegible]	5.2000000
20	-31.127[illegible]	31.2499998

MAIN LOBE NULL AND FIRST 20 SIDE-LOBES TO RIGHT OF (ABOVE) MAIN LOBE

RANK	REL. GAIN (DB)	TRUE ANGLE (DEG)	REL. ANGLE (DEG)
MAIN LOBE	** NULL **	1.4000000	
1	-13.439[illegible]	1.6000000	0.6500000
2	-18.067[illegible]	2.0500000	1.1000000
3	-21.134[illegible]	2.5000000	1.5500000
4	-23.392[illegible]	2.9500000	2.0000000
5	-25.279[illegible]	3.4000000	2.4500000
6	-26.903[illegible]	3.8500000	2.9000000
7	-28.268[illegible]	4.3000000	3.3500000
8	-29.500[illegible]	4.7499999	3.8000000
9	-30.656[illegible]	5.2000000	4.2500000
10	-31.675[illegible]	5.6500000	4.7000000
11	-32.600[illegible]	6.1000000	5.1500000
12	-33.417[illegible]	6.5500000	5.6000000
13	-34.241[illegible]	6.9999999	6.0500000
14	-34.761[illegible]	7.4499999	6.4999999
15	-35.278[illegible]	7.9000001	6.9500000
16	-35.819[illegible]	8.3499999	7.3999999
17	-36.188[illegible]	8.8000001	7.8500000
18	-36.696[illegible]	9.2500000	8.3000001
19	-36.955[illegible]	9.7500001	8.8000001
20	-37.293[illegible]	10.2500000	9.3000001

MAIN LOBE NULL AND FIRST 20 SIDE-LOBES TO LEFT OF (BELOW) MAIN LOBE

RANK	REL. GAIN (DB)	TRUE ANGLE (DEG)	REL. ANGLE (DEG)
MAIN LOBE	** NULL **	0.5000000	
1	-13.535[illegible]	0.3000000	-0.6500000
2	-18.176[illegible]	-0.1500000	-1.1000000
3	-21.278[illegible]	-0.6000000	-1.5500000
4	-23.631[illegible]	-1.0500000	-2.0000000
5	-25.585[illegible]	-1.5000000	-2.4500000
6	-27.274[illegible]	-1.9500000	-2.9000000
7	-28.699[illegible]	-2.4000000	-3.3500000
8	-29.993[illegible]	-2.8500000	-3.8000001
9	-31.179[illegible]	-3.3000000	-4.2500000
10	-32.312[illegible]	-3.7500000	-4.7000000
11	-33.297[illegible]	-4.2000000	-5.1500000
12	-34.263[illegible]	-4.6500000	-5.6000000

NO FURTHER SIDE LOBES ON THIS SIDE

• • • • ANTENNA LOBE SCANNER • • • •

SNUMB=7478T
5-16,Pass#2

THE MAIN LOBE GAIN IS 55.2212550

LOCATION AND RELATIVE GAIN OF HIGHEST 20 SIDE LOBES

RANK	REL. GAIN (DB)	ANGLE (DEG)
MAIN	0.0	0.9500000
1	-2.4846993	15.4999999
2	-2.5919332	31.1499999
3	-5.8790169	15.0500000
4	-6.0360947	30.1999998
5	-7.1381884	15.9499999
6	-7.3153519	32.2500000
7	-31.7532468	28.4499998
8	-33.7454100	34.5499997
9	-37.0932474	4.3000000
10	-38.2104859	26.5500000
11	-40.1887589	8.0999999
12	-40.2117572	8.1999999
13	-40.2974110	23.0500000
14	-40.3358025	23.1499999
15	-40.3545470	21.5500000
16	-40.3904519	21.6499999
17	-40.4418159	22.3499999
18	-40.4878526	22.4499998
19	-40.4972458	22.2500000
20	-40.5148139	6.9499999

MAIN LOBE NULL AND FIRST 20 SIDE-LOBES TO RIGHT OF (ABOVE) MAIN LOBE

RANK	REL. GAIN (DB)	TRUE ANGLE (DEG)	REL. ANGLE (DEG)
MAIN LOBE	•• NULL ••	4.2499999	
1	-37.0932474	4.3000000	3.3500000
2	-40.5148139	6.9499999	5.9999999
3	-40.6208129	7.1500000	6.2000000
4	-40.6737127	7.2499999	6.3000000
5	-40.7351275	7.4499999	6.4999999
6	-40.7522106	7.6000000	6.6500000
7	-40.1887589	8.0999999	7.1499999
8	-40.2117572	8.1999999	7.2499999
9	-40.7053356	8.8499999	7.8999999
10	-40.6591134	9.0500000	8.1000000
11	-5.8790169	15.0500000	14.1000000
12	-2.4846993	15.4999999	14.5500000
13	-7.1381884	15.9499999	15.0000000
14	-40.3545470	21.5500000	20.5999999
15	-40.3904519	21.6499999	20.6999998
16	-40.5725279	22.0000000	21.0500000
17	-40.5834646	22.0999999	21.1499999
18	-40.4972458	22.2500000	21.3000000
19	-40.4418159	22.3499999	21.3999999
20	-40.4878526	22.4499998	21.4999998

MAIN LOBE NULL AND FIRST 20 SIDE-LOBES TO LEFT OF (BELOW) MAIN LOBE

RANK	REL. GAIN (DB)	TRUE ANGLE (DEG)	REL. ANGLE (DEG)

NO FURTHER SIDE LOBES ON THIS SIDE

SNUMB=2726T
5-09,Pass#1

• • • • ANTENNA LOBE SCANNER • • • •

THE MAIN LOBE GAIN IS 55.0[illegible]2494

LOCATION AND RELATIVE GAIN OF HIGHEST 20 SIDE LOBES

RANK	REL. GAIN (DB)	ANGLE (DEG)
MAIN	0.0	0.9500000
1	-2.4836855	15.4999999
2	-2.5794106	31.1499999
3	-5.863 963	15.0500000
4	-5.9979857	30.1999998
5	-7.1[illegible]9.832	15.9499999
6	-7.2632599	32.2500000
7	-16.7[illegible]4564	7.6999999
8	-20.140957[illegible]	23.0000000
9	-20.2598867	22.2500000
1[illegible]	-20.[illegible]796637	6.5999999
11	-21.4241047	0.3000000
12	-21.5799198	0.1000000
13	-22.3614588	24.0000000
14	-25.813 264	29.1499999
15	-26.2 86525	16.8999999
16	-26.3[illegible]13611	33.4000001
17	-27.0135508	2.7500000
18	-27.5828614	-0.7000000
19	-28.092373[illegible]	17.3999999
2[illegible]	-28.3593240	-4.9000000

MAIN LOBE [illegible]LL AND FIRST 2[illegible] SIDE-LOBES TO RIGHT OF (ABOVE) MAIN LOBE

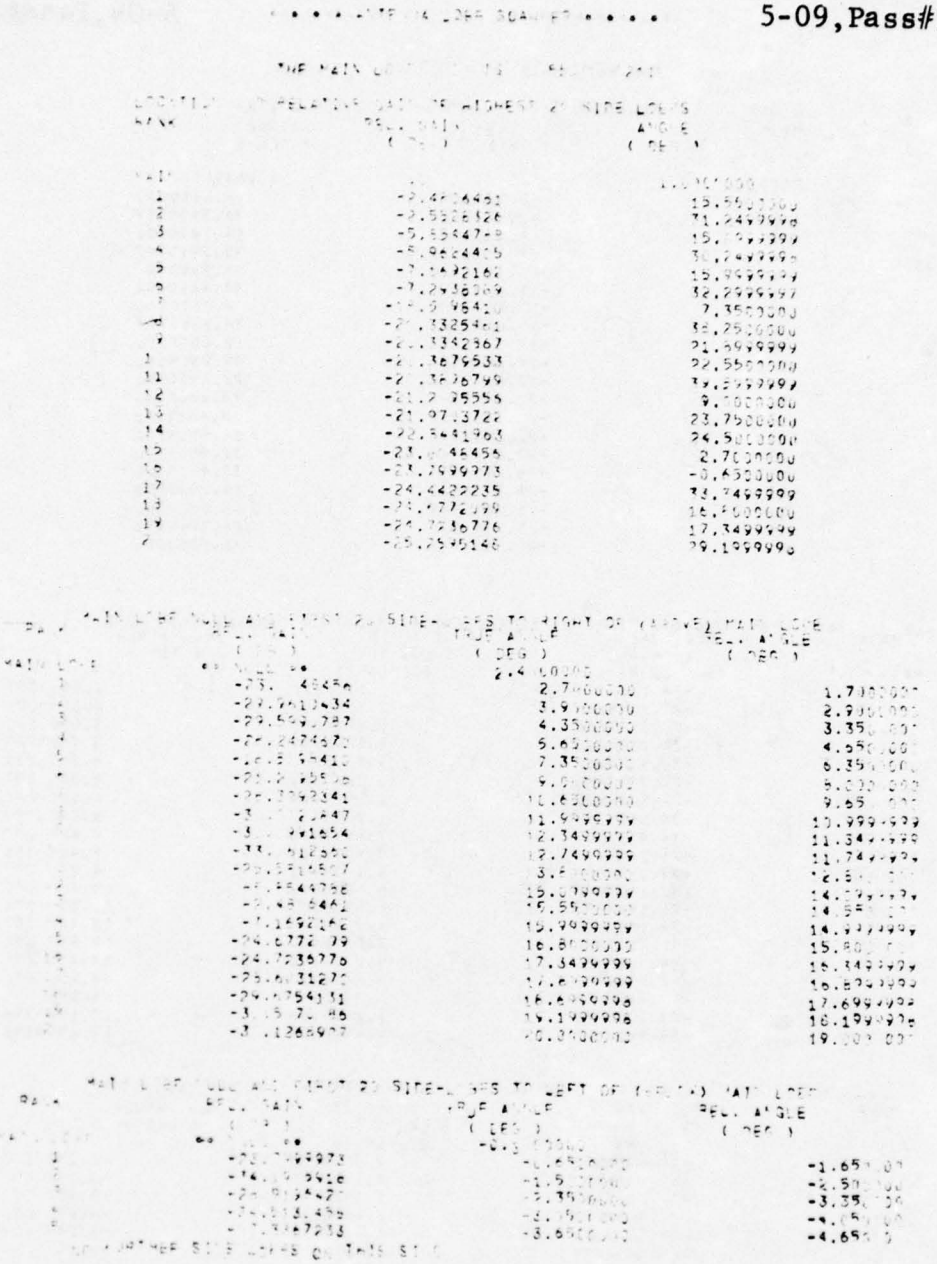
RANK	REL. GAIN (DB)	TRUE ANGLE (DEG)	REL. ANGLE (DEG)
MAIN LOBE	•• NULL ••	2.4500000	
1	-27.0135508	2.7500000	1.8000000
2	-3[illegible].8790717	3.6000000	2.650 000
3	-32.0056252	4.4999999	3.550.000
4	-32.5552344	4.9500000	4.000[illegible]000
5	-32.[illegible]639330	5.9000000	4.950.000
6	-28.411.231	6.8000000	5.850[illegible]000
7	-18.7094564	7.6999999	6.7499999
8	-2[illegible].8796637	8.5999999	7.6499999
9	-2[illegible].6821 34	9.4000000	8.450[illegible]000
1[illegible]	-32.1293 06	10.3499999	9.4000[illegible]00
11	-33.6987247	11.150[illegible]000	10.200 [illegible]00
12	-35.[illegible]62518	11.4499999	10.500[illegible]000
13	-33.2539105	12.1999999	11.250[illegible]000
14	-32.3952518	12.650[illegible]000	11.700[illegible]000
15	-5.8[illegible]0963	15.050[illegible]000	14.100[illegible]000
16	-2.4836855	15.4999999	14.550[illegible]000
17	-7.1[illegible].832	15.9499999	15.000.000
18	-26.2[illegible]6525	16.8999999	15.9499999
19	-28.0923738	17.3999999	16.4499998
2[illegible]	-31.1577892	17.8999999	16.9499998

MAIN LOBE [illegible]ULL AND FIRST 2[illegible] SIDE-LOBES TO LEFT OF (BELOW) MAIN LOBE

RANK	REL. GAIN (DB)	TRUE ANGLE (DEG)	REL. ANGLE (DEG)
MAIN LOBE	•• NULL ••	0.3[illegible]00000	
1	-21.4241 47	0.3000000	-0.65[illegible]000
2	-21.5799198	0.1000000	-0.85[illegible]000
3	-27.5823614	-0.7000000	-1.65[illegible]000
4	-31.4[illegible]5728	-1.7[illegible]0000	-2.650[illegible]000
5	-32.5823209	-2.2500000	-3.200[illegible]000
6	-33.4123725	-3.2[illegible]0000	-4.20[illegible]000
7	-31.1237198	-4.0000000	-4.95[illegible]000
8	-28.3593240	-4.9000000	-5.65[illegible]000

NO FURTHER SIDE LOBES ON THIS SIDE

SNUMB=4288T
5-09, Pass#1



SNUMB=4288T
5-09,Pass#5

• • • • • ANTENNA LOBE SCATTER • • • • •

THE MAIN LOBE GAIN IS 54.99[illegible]24

LOCATION AND RELATIVE GAIN OF HIGHEST 20 SIDE LOBES

RANK	REL. GAIN (DB)	ANGLE (DEG)
MAIN	[illegible]	4.9999999
1	-2.8352187	19.6499999
2	-2.9279569	36.3499999
3	-4.0[illegible]1544[illegible]	19.3999999
4	-4.0857371	35.2999997
5	-1[illegible].7922754	20.349999
6	-11.116[illegible]574	37.4499996
7	-17.3676915	6.0500000
8	-18.837[illegible]961	34.2999997
9	-19.1845757	2.0000000
10	-19.8625920	39.2500000
11	-19.9629126	22.6999996
12	-2[illegible].4859345	23.2500000
13	-2[illegible].994[illegible]252	32.4499996
14	-21.1459393	16.5500000
15	-23.8[illegible]81846	31.5500000
16	-24.1214104	33.4000001
17	-24.5799527	11.0999999
18	-25.315[illegible]845	-3.2500000
19	-25.336[illegible]500	26.0999999
20	-25.5411644	-1.0500000

MAIN LOBE NULL AND FIRST 20 SIDE-LOBES TO RIGHT OF (ABOVE) MAIN LOBE

RANK	REL. GAIN (DB)	TRUE ANGLE (DEG)	REL. ANGLE (DEG)
MAIN LOBE	** NULL **	6.[illegible]00000	
1	-26.1417379	6.5500000	1.5500000
2	-27.81[illegible]4644	7.3000000	2.3000000
3	-1[illegible].3676815	8.0500000	3.0500000
4	-32.2155323	8.6999999	3.7000000
5	-32.4173613	9.5000000	4.5000001
6	-27.3997410	10.3499999	5.3500000
7	-26.5799522	11.0999999	6.1000000
8	-34.[illegible]62[illegible]394	11.9000000	6.900[illegible]
9	-34.4155394	12.5999999	7.600[illegible]
10	-26.[illegible]877427	13.4000000	8.400[illegible]001
11	-29.[illegible]477221	14.1999999	9.20[illegible]
12	-33.1637392	15.6999999	10.700[illegible]
13	-21.1459393	16.5500000	11.55[illegible]001
14	-25.1413112	17.3999999	12.400[illegible]
15	-3[illegible].21[illegible]5281	17.8499999	12.850[illegible]
16	-4.[illegible]01544[illegible]	19.3999999	14.40[illegible]
17	-2.8382[illegible]37	19.6499999	14.650[illegible]
18	-1[illegible].7922754	[illegible].3499999	15.35[illegible]
19	-27.2981[illegible]3[illegible]	[illegible]2.1999998	17.1999998
20	-19.962[illegible]126	22.6999998	17.6999998

MAIN LOBE NULL AND FIRST 20 SIDE-LOBES TO LEFT OF (BELOW) MAIN LOBE

RANK	REL. GAIN (DB)	TRUE ANGLE (DEG)	REL. ANGLE (DEG)
MAIN LOBE	** NULL **	3.[illegible]00000	
1	-2[illegible].8281430	2.7500000	-2.2500000
2	-2[illegible].[illegible]85[illegible]57	2.[illegible]	-3.000[illegible]
3	-2[illegible].[illegible]86[illegible]5[illegible]	1.[illegible]	-3.850[illegible]
4	-1[illegible].[illegible]54776	[illegible].4000000	-4.600[illegible]
5	-2[illegible].05[illegible]	-0.[illegible]	-5.2499999
6	-2[illegible].5411644	-1.05000000	-6.050[illegible]
7	-3[illegible]	-1.8[illegible]	-6.8[illegible]
8	[illegible]2[illegible]	-2.5[illegible]	-7.4[illegible]
9	-2[illegible].[illegible]5[illegible]845	-3.2[illegible]	-8.2499999
10	-2[illegible].[illegible]445[illegible]	-4.[illegible]	-8.999[illegible]
11	[illegible].[illegible]37	-4.[illegible]	-9.[illegible]

NO FURTHER SIDE LOBES ON THIS SIDE

SNUMB=4288T
5-09, Pass#4

• • • • ANTENNA LOBE SCANNER • • • •

THE MAIN LOBE GAIN IS 34.0000000

LOCATION AND RELATIVE GAIN OF HIGHEST 20 SIDE LOBES

BEAM	REL. GAIN (DB)	ANGLE (DEG)
MAIN	.0	4.0000000
1	-2.7545234	18.7500000
2	-2.798 435	35.0499997
3	-4.4271803	18.3499999
4	-4.4477348	34.0000000
5	-9.4542144	19.2500000
6	-9.765 588	36.1499996
7	-17.54.4549	0.6500000
8	-19.7191213	7.3500000
9	-19.3751888	15.1999999
1	-19.5112791	30.8000000
11	-21.4403177	33.0499997
12	-21.61.0607	39.5499997
13	-21.7475105	36.2999997
14	-21.8624814	22.5000000
15	-21.9361954	21.9499998
16	-22.2252347	29.9499998
17	-23.757556.	31.7499998
18	-24.7724407	-2.6500000
19	-25.1661019	11.6999999
2	-25.643 407	26.8499999

MAIN LOBE NULL AND FIRST 20 SIDE-LOBES TO RIGHT OF (ABOVE) MAIN LOBE

BEAM	REL. GAIN (DB)	TOP ANGLE (DEG)	REL. ANGLE (DEG)
MAIN LOBE	** NULL **	5.4500000	
1	-29.2922153	5.5300000	1.5500000
2	-24.7777727	5.9999999	2.0000000
3	-29.7315798	6.3000000	2.3000000
4	-19.2151213	7.3500000	3.3500000
5	-27.9777420	6.3499999	4.3500000
6	-33.7192223	9.6999999	5.7000000
7	-25.0424521	10.6999999	6.7000000
8	-25.866. 19	11.6999999	7.7000000
9	-32.42 6636	13.0500000	9.0500000
1	-26.2343774	14.1500000	10.1500000
11	-19.3751888	15.1999999	11.1999999
12	-31.2529831	16.3000000	12.3000000
13	-4.4271803	18.3499999	14.3499999
14	-2.7543204	18.7500000	14.7500000
15	-9.6362144	19.2500000	15.2500000
16	-26.5[illegible]9421	20.3999999	16.3999999
17	-29.8071648	20.8499999	16.8499999
18	-29.1052933	21.3499999	17.3499999
19	-21.9361954	21.9499998	17.9499998
2	-21.8824816	22.5100000	18.5000000

MAIN LOBE NULL AND FIRST 20 SIDE-LOBES TO LEFT OF (BELOW) MAIN LOBE

BEAM	REL. GAIN (DB)	TOP ANGLE (DEG)	REL. ANGLE (DEG)
MAIN LOBE	** NULL **	3.1[illegible]0000	
1	-25.9336397	2.9000000	-1.1000000
2	-3 .3955268	1.7000000	-2.3000000
3	-17.54 4549	0.6500000	-3.350 000
4	-37.1435351	-0.3500000	-4.3500000
5	-21.9767904	-1.4500000	-5.45000
6	-24.7724607	-2.6500000	-6.650[illegible]0
7	-26. 787678	-3.6500000	-7.650[illegible]0
8	-33.54 8912	-4.6000000	-8.600 00
9	-31.5171746	-4.8500000	-8.850[illegible]0

NO FURTHER SIDE LOBES ON THIS SIDE

SNUMB=4288T
5-09, Pass#3

• • • • ANTENNA LOBE SCANNER • • • •

THE MAIN LOBE GAIN IS 54.9932375

LOCATION AND RELATIVE GAIN OF HIGHEST 20 SIDE LOBES

RANK	REL. GAIN (DB)	ANGLE (DEG)
MAIN	0.0	3.6000000
1	-2.5517938	17.6999998
2	-3.6334940	33.7500000
3	-4.3157753	17.2500000
4	-4.9379854	32.7500000
5	-8.7231207	16.1499999
6	-8.9643269	34.8499999
7	-17.9851227	7.6999999
8	-19.5 65775	-1.6500000
9	-20.1807222	22.3000000
1	-20.3108320	22.6999999
11	-2 .3134661	12.7499999
12	-21.3275318	36.7500000
13	-21.0 0 521	27.9999998
14	-21.6778430	31.6499999
15	-23.9905586	26.8499999
16	-25.1331339	27.5999999
17	-25.4916690	27.2499998
18	-25.7633295	4.0500000
19	-26.127 509	11.7500000
2	-28.8332206	7.5499997

MAIN LOBE NULL AND FIRST 20 SIDE-LOBES TO RIGHT OF (ABOVE) MAIN LOBE

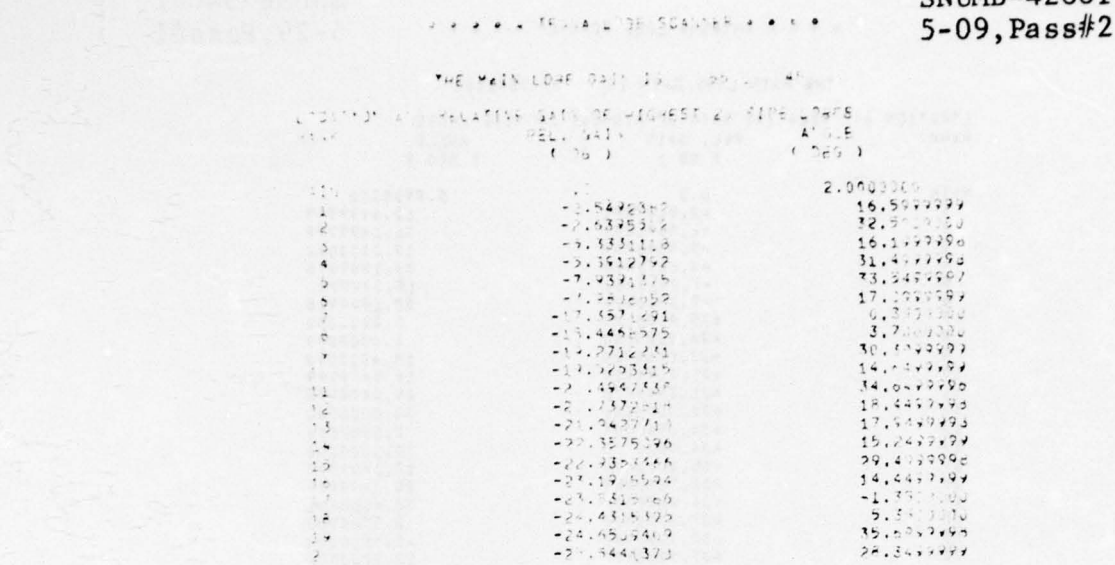
RANK	REL. GAIN (DB)	TRUE ANGLE (DEG)	REL. ANGLE (DEG)
MAIN LOBE	•• NULL ••	4.0000000	
1	-25.7633295	4.0500000	1.0500000
2	-32.5365181	6.2000000	3.2000000
3	-17.9851227	7.6999999	4.7000000
4	-34.7481565	9.3499997	6.3500000
5	-36.2331332	10.8499999	7.8500000
6	-27.3134661	12.7499999	9.7499999
7	-33.2125606	13.8000000	10.8000000
8	-34.4335542	14.1500000	11.1500000
9	-34.4762616	14.9000000	11.9000000
1	-4.6167753	17.2500000	14.2500000
11	-2.5517938	17.6999998	14.6999998
12	-8.7231207	18.1499999	15.1499999
13	-32.7331843	20.6999998	17.6999998
14	-28.127.539	21.7500000	18.7500000
15	-2 .19 7222	22.3000000	19.3000000
16	-2 .31 8320	22.6999999	19.6999999
17	-35.6161936	24.5500000	21.5500000
18	-33.98 7392	4.9499997	21.9499998
19	-36.3459754	5.8000000	22.3000000
2	-25.4916690	27.2499998	24.2499998

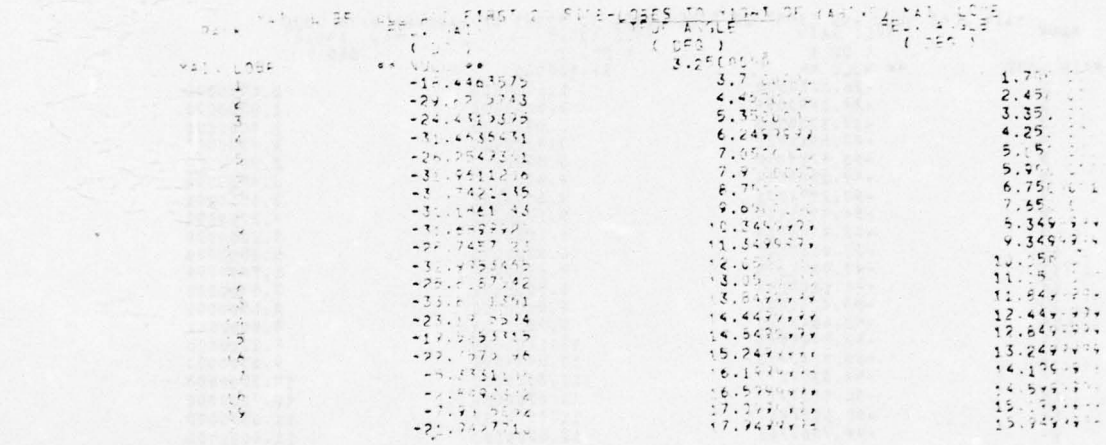
MAIN LOBE NULL AND FIRST 2 SIDE-LOBES TO LEFT OF (BELOW) MAIN LOBE

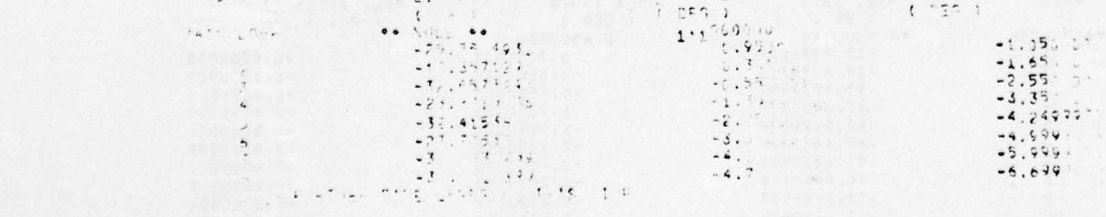
RANK	REL. GAIN (DB)	TRUE ANGLE (DEG)	REL. ANGLE (DEG)
MAIN LOBE	•• NULL ••	1.9500000	
1	-3 .1511960	1.4000000	-1.6000000
2	-33.7569133	0.4500000	-2.6000000
3	-32.9464358	-0.6000000	-3.6500000
4	-19.5 65775	-1.6500000	-4.7000000
5	-25.4337351	-3.1000000	-6.0999999
6	-31.2 9625	4.0500000	-7.0500000

NO FURTHER SIDE LOBES ON THIS SIDE

SNUMB=4288T
5-09, Pass#2







SNUMB=3404T
5-29, Pass#1

• • • • ANTENNA LOBE SCANNER • • • •

THE MAIN LOBE GAIN IS 55.5692101

LOCATION AND RELATIVE GAIN OF HIGHEST 20 SIDE LOBES

RANK	REL. GAIN (DB)	ANGLE (DEG)
MAIN	0.0	0.9500000
1	-2.5167341	15.4999999
2	-2.5661049	31.1499999
3	-5.9850769	15.0500000
4	-6.0276098	30.1999998
5	-7.2518663	15.949999.
6	-7.3308525	32.1999998
7	*25.9125128	0.3000000
8	*26.8225000	1.6000000
9	-30.0418720	14.4000000
10	*31.0144300	16.6499999
11	*31.3987772	29.4499998
12	*32.3351212	33.0000000
13	*34.0490084	2.0000000
14	*34.4856710	*0.1000000
15	*35.4602690	17.0999999
16	*35.7845554	28.3999999
17	*36.9889307	33.4000001
18	*37.3338518	2.5500000
19	*37.3935947	*0.6500000
20	*37.5218487	13.9000000

MAIN LOBE NULL AND FIRST 20 SIDE-LOBES TO RIGHT OF (ABOVE) MAIN LOBE

RANK	REL. GAIN (DB)	TRUE ANGLE (DEG)	REL. ANGLE (DEG)
MAIN LOBE	** NULL **	1.4500000	
1	-26.0225000	1.6000000	0.6500000
2	-34.0490084	2.0000000	1.0500000
3	-37.3338518	2.5500000	1.6000000
4	-47.8516922	3.4000000	2.4500000
5	-50.4714656	3.8500000	2.9000000
6	-49.2536564	4.4000000	3.4500000
7	-50.2272301	4.6000000	3.6500000
8	-54.4931464	5.1500000	4.2000000
9	-53.9364934	6.1500000	5.2000000
10	-52.8368101	6.8000000	5.8500000
11	-43.9571075	7.6999999	6.7499999
12	-46.1468163	8.5000000	7.5500000
13	-53.4251280	9.5000000	8.5500001
14	-53.4849720	9.7500000	8.8000001
15	-53.5996923	10.1500000	9.2000000
16	-55.9060473	10.5999999	9.6500000
17	-54.3259277	11.3000000	10.3500000
18	-50.4157414	11.6500000	10.7000000
19	-50.1002817	11.9999999	11.0500000
20	-49.9505701	12.5500000	11.6000000

MAIN LOBE NULL AND FIRST 20 SIDE-LOBES TO LEFT OF (BELOW) MAIN LOBE

RANK	REL. GAIN (DB)	TRUE ANGLE (DEG)	REL. ANGLE (DEG)
MAIN LOBE	** NULL **	0.4500000	
1	-25.9125128	0.3000000	-0.6500000
2	-34.4856710	-0.1000000	-1.0500000
3	-37.3935947	-0.6500000	-1.6000000
4	-47.3800077	-1.5000000	-2.4500000
5	-50.9498529	-1.9500000	-2.9000000
6	-49.4613333	-2.4500000	-3.4000000
7	-50.6898768	-2.7000000	-3.6500000
8	-54.9968476	-3.2500000	-4.2000000
9	-53.5686808	-4.2500000	-5.2000000
10	-52.7704592	-4.9000000	-5.8500000

NO FURTHER SIDE LOBES ON THIS SIDE

SNUMB=8462T
6-17,Pass#1

• • • • ANTENNA CUT SCANNER • • • •

THE MAIN LOBE GAIN IS 55.491 DB

LOCATION AND RELATIVE GAIN OF HIGHEST 20 SIDE LOBES

PEAK	REL. GAIN (DB)	ANGLE (DEG)
MAIN	0.0	0.9500000
1	-2.5 58384	15.4999999
2	-2.5544112	31.1499999
3	-5.9514198	15.0500000
4	-6.0192556	30.1999998
5	-7.2278962	15.9499999
6	-7.32.1475	32.1999998
7	-23.7118378	1.5500000
8	-23.7722270	0.3500000
9	-27.4797335	14.4000000
10	-28.2479124	16.5999999
11	-28.5554416	29.4999998
12	-29.4874029	33.0000000
13	-30.1996996	2.0000000
14	-30.2229452	-0.1000000
15	-32.1114631	17.0999999
16	-32.5647002	13.9499999
17	-33.2165965	2.5000000
18	-33.2269337	-0.6500000
19	-33.6 5E393	28.3999999
20	-34.2112550	13.4999999

MAIN LOBE AND FIRST 20 SIDE-LOBES TO RIGHT OF (ABOVE) MAIN LOBE

PEAK	REL. GAIN (DB)	TRUE ANGLE (DEG)	REL. ANGLE (DEG)
MAIN LOBE	** WELL **	1.5000000	
1	-23.7115378	1.5500000	0.6000000
2	-27.1995576	2.0000000	1.0500000
3	-33.2169555	2.5000000	1.5500000
4	-40.495.676	4.8000000	3.3500000
5	-43.3712325	6.1000000	5.1500000
6	-44.1933137	6.9999999	6.0500000
7	-44.2735744	7.3000000	6.3500000
8	-44.3781169	7.4499999	6.4999999
9	-43.1949364	8.0999999	7.1499999
10	-44.3167211	8.8499999	7.8999999
11	-43.5519743	9.9000000	8.9500001
12	-40.2755515	10.1999999	9.2500000
13	-41.[illegible]	11.6999999	10.7500000
14	-34.9112550	13.4999999	12.5500000
15	-32.5647002	13.9499999	13.0000000
16	-27.4797335	14.4000000	13.4500000
17	-2.9514174	15.0500000	14.1000000
18	-2.5 58384	15.4999999	14.5500000
19	-7.6 7E[illegible]2	15.9499999	15.0000000
20	-28.2479124	16.5999999	15.6500000

MAIN LOBE AND FIRST 20 SIDE-LOBES TO LEFT OF (BELOW) MAIN LOBE

PEAK	REL. GAIN (DB)	TRUE ANGLE (DEG)	REL. ANGLE (DEG)
MAIN LOBE	** WELL **	0.4000000	
1	-23.7722727	0.3500000	-0.6000000
2	-27.[illegible]9248	-0.1000000	-1.0500000
3	-33.2[illegible]7737	-0.6500000	-1.6000000
4	-40.[illegible]5	-2.4000000	-3.3500000
5	-43.[illegible]7	-4.2000000	-5.1500000

NO FURTHER SIDE LOBES ON THIS SIDE

• • • • ANTENNA LOBE SCANNER • • • •

SNUMB=8462T
6-17, Pass#2

THE MAIN LOBE GAIN IS 55.2142419

LOCATION AND RELATIVE GAIN OF HIGHEST 20 SIDE LOBES

RANK	REL. GAIN (DB)	ANGLE (DEG)
MAIN	0.0	2.0000000
1	-2.5463357	16.5999999
2	-2.6141109	32.5000000
3	-5.3408642	16.1999996
4	-5.4335232	31.4999996
5	-7.9490004	17.0999999
6	-8.0833187	33.5499997
7	-31.2033563	29.6999996
8	-40.1503239	9.1999999
9	-40.2832460	24.3499999
10	-40.2913361	24.2500000
11	-40.3650533	-5.0000000
12	-40.4386760	22.8499999
13	-40.4184728	23.5500000
14	-40.4176477	23.6499999
15	-40.4469256	22.9499998
16	-40.4520454	25.3000000
17	-40.4697412	25.1999998
18	-40.4972954	23.0500000
19	-40.5306375	-4.0500000
20	-40.5429564	24.9499998

MAIN LOBE NULL AND FIRST 20 SIDE-LOBES TO RIGHT OF (ABOVE) MAIN LOBE

RANK	REL. GAIN (DB)	TRUE ANGLE (DEG)	REL. ANGLE (DEG)
MAIN LOBE	•• NULL ••	8.1999999	
1	-40.6137716	6.2500000	6.2500001
2	-40.6163195	6.3499999	6.3500000
3	-40.6651263	6.4499999	6.4500000
4	-40.6837897	6.5500000	6.5500000
5	-40.7205945	6.6500000	6.6500000
6	-40.6949120	6.7500000	6.7500001
7	-40.1513234	9.1999999	7.2000000
8	-40.0384926	9.5999999	7.6000000
9	-40.6919232	9.6999999	7.7000000
10	-40.7249276	9.8000000	7.8000000
11	-40.6973241	9.9000000	7.9000000
12	-40.6834808	10.0000000	8.0000000
13	-5.3419642	16.1999998	14.1999998
14	-2.5463357	16.5999999	14.5999999
15	-7.9490004	17.0999999	15.0999999
16	-40.4089790	22.8499999	20.8499999
17	-40.4469256	22.9499998	20.9499998
18	-40.4972954	23.0500000	21.0500000
19	-40.5612282	23.1999996	21.1999998
20	-40.5769963	23.3000000	21.3000000

MAIN LOBE NULL AND FIRST 20 SIDE-LOBES TO LEFT OF (BELOW) MAIN LOBE

RANK	REL. GAIN (DB)	TRUE ANGLE (DEG)	REL. ANGLE (DEG)
MAIN LOBE	•• NULL ••	-4.0000000	
1	-40.5306375	-4.0500000	-6.0500000
2	-40.6333852	-4.2500000	-6.2499999
3	-40.6871495	-4.3500000	-6.3500000
4	-40.6955754	-4.4500000	-6.4499999
5	-40.7114678	-4.5500000	-6.5500000
6	-40.7217866	-4.6500000	-6.6499999

NO FURTHER SIDE LOBES ON THIS SIDE

SNUMB=4171T
1-23,Pass#4

* * * * ANTENNA LOBE SCANNER * * * *

THE MAIN LOBE GAIN IS 45.3014589

LOCATION AND RELATIVE GAIN OF HIGHEST 20 SIDE LOBES

RANK	REL. GAIN (DB)	ANGLE (DEG)
MAIN	0.0	4.9999999
1	-12.8325224	5.6500000
2	-12.9156017	4.3500000
3	-17.1066046	7.9999999
4	-17.1510983	3.9000000
5	-17.4322457	6.1000000
6	-18.6072278	6.6000000
7	-18.6364379	3.4000000
8	-19.3693361	2.0000000
9	-19.8984404	3.1000000
10	-20.0768418	6.9000000
11	-22.8662930	7.4499999
12	-23.3056126	2.5500000
13	-24.6341152	8.6999999
14	-24.8616910	1.3500000
15	-25.8714886	-0.2500000
16	-26.0027361	11.0999999
17	-26.5033784	-1.0500000
18	-26.6322899	10.3000000
19	-27.3211093	-2.1500000
20	-27.7068319	12.1999999

MAIN LOBE NULL AND FIRST 20 SIDE-LOBES TO RIGHT OF (ABOVE) MAIN LOBE

RANK	REL. GAIN (DB)	TRUE ANGLE (DEG)	REL. ANGLE (DEG)
MAIN LOBE	** NULL **	5.4500000	
1	-12.8325224	5.6500000	0.6500000
2	-17.4322457	6.1000000	1.1000000
3	-18.6072278	6.6000000	1.6000000
4	-20.0768418	6.9000000	1.9000000
5	-22.8662930	7.4499999	2.4500000
6	-17.1066046	7.9999999	3.0000000
7	-24.6341152	8.6999999	3.7000000
8	-28.2117429	9.2500000	4.2500001
9	-29.0479412	9.6999999	4.7000000
10	-26.6322899	10.3000000	5.3000000
11	-26.0027361	11.0999999	6.1000000
12	-27.7068319	12.1999999	7.2000000
13	-30.1534753	13.4000000	8.4000001
14	-31.3760986	14.0500000	9.0500001
15	-35.8230948	14.9000000	9.9000001
16	-35.9558244	15.4499999	10.4500000
17	-34.3484225	15.9499999	10.9500000
18	-32.7574086	16.3999999	11.4000000
19	-37.3014741	17.2500000	12.2500001
20	-37.2819552	17.7500000	12.7500001

MAIN LOBE NULL AND FIRST 20 SIDE-LOBES TO LEFT OF (BELOW) MAIN LOBE

RANK	REL. GAIN (DB)	TRUE ANGLE (DEG)	REL. ANGLE (DEG)
MAIN LOBE	** NULL **	4.5500000	
1	-12.9156017	4.3500000	-0.6500000
2	-17.1510983	3.9000000	-1.1000000
3	-18.6364379	3.4000000	-1.6000000
4	-19.8984404	3.1000000	-1.9000000
5	-23.3056126	2.5500000	-2.4500000
6	-19.3693361	2.0000000	-3.0000000
7	-24.8616910	1.3500000	-3.6499999
8	-28.0751691	0.7500000	-4.2499999
9	-29.0480886	0.3500000	-4.6500000
10	-25.8714886	-0.2500000	-5.2499999
11	-26.5033784	-1.0500000	-6.0500000
12	-27.3211093	-2.1500000	-7.1499999
13	-28.8733954	-3.3000000	-8.3000000
14	-31.2834849	-3.9500000	-8.9499999
15	-35.1468053	-4.7500000	-9.7499999

NO FURTHER SIDE LOBES ON THIS SIDE

SNUMB=4171T
1-23,Pass#3

* * * * ANTENNA LOBE SCANNER * * * *

THE MAIN LOBE GAIN IS 45.3062787

LOCATION AND RELATIVE GAIN OF HIGHEST 20 SIDE LOBES

RANK	REL. GAIN (DB)	ANGLE (DEG)
MAIN	0.0	4.0000000
1	-12.9113693	4.6500000
2	-12.9867535	3.3500000
3	-16.9168215	0.6500000
4	-17.0769958	2.9000000
5	-17.2355175	5.1000000
6	-18.6066890	2.4000000
7	-18.7579422	5.6000000
8	-19.5047774	7.3500000
9	-20.0967965	5.9000000
10	-23.3996201	1.5500000
11	-24.1155694	6.4499999
12	-25.9086833	8.3000000
13	-26.2006450	-0.2500000
14	-26.3002996	-2.7000000
15	-26.6671405	-3.0000000
16	-27.4557061	11.1999999
17	-27.6302671	10.6999999
18	-27.6561465	10.8000000
19	-27.8421469	-1.3000000
20	-28.1754189	9.4000000

MAIN LOBE NULL AND FIRST 20 SIDE-LOBES TO RIGHT OF (ABOVE) MAIN LOBE

RANK	REL. GAIN (DB)	TRUE ANGLE (DEG)	REL. ANGLE (DEG)
MAIN LOBE	** NULL **	4.4500000	
1	-12.9113693	4.6500000	0.6500000
2	-17.2355175	5.1000000	1.1000000
3	-18.7579422	5.6000000	1.6000000
4	-20.0967965	5.9000000	1.9000000
5	-24.1185694	6.4499999	2.4500000
6	-19.5047774	7.3500000	3.3500000
7	-25.9086833	8.3000000	4.3000000
8	-28.1754189	9.4000000	5.4000000
9	-31.8925085	10.0999999	6.1000000
10	-27.6302671	10.6999999	6.7000000
11	-27.6561465	10.8000000	6.8000000
12	-27.4557061	11.1999999	7.2000000
13	-32.9786391	12.9999999	8.9999999
14	-35.2119956	13.9499999	9.9499999
15	-34.9890203	14.4000000	10.4000000
16	-29.6211980	15.1500000	11.1500000
17	-38.4253068	16.1999998	12.1999998
18	-38.3207850	16.6499999	12.6499999
19	-39.8750615	17.0500000	13.0500000
20	-42.8657665	17.5500000	13.5500000

MAIN LOBE NULL AND FIRST 20 SIDE-LOBES TO LEFT OF (BELOW) MAIN LOBE

RANK	REL. GAIN (DB)	TRUE ANGLE (DEG)	REL. ANGLE (DEG)
MAIN LOBE	** NULL **	3.5000000	
1	-12.9867535	3.3500000	-0.6500000
2	-17.0769958	2.9000000	-1.1000000
3	-18.6066890	2.4000000	-1.6000000
4	-23.3996201	1.5500000	-2.4500000
5	-16.9168215	0.6500000	-3.3500000
6	-26.2006450	-0.2500000	-4.2500000
7	-27.8421469	-1.3000000	-5.3000000
8	-31.2047071	-2.0000000	-5.9999999
9	-26.3002996	-2.7000000	-6.7000000
10	-26.6671405	-3.0000000	-6.9999999
11	-31.9049001	-4.9000000	-8.9000000

NO FURTHER SIDE LOBES ON THIS SIDE

SNUMB=4171T
1-23,Pass#2

* * * * ANTENNA LOBE SCANNER * * * *

THE MAIN LOBE GAIN IS 45.2996330

LOCATION AND RELATIVE GAIN OF HIGHEST 20 SIDE LOBES

RANK	REL. GAIN (DB)	ANGLE (DEG)
MAIN	0.0	3.0000000
1	-12.8041649	2.3500000
2	-12.9315119	3.6500000
3	-17.2201748	4.1000000
4	-17.4370646	1.9000000
5	-18.1365647	7.6999999
6	-18.6271539	4.6000000
7	-18.7666278	1.4000000
8	-19.9463053	4.9000000
9	-20.7159443	-1.7000000
10	-24.0719504	5.4500000
11	-24.2982287	0.5500000
12	-24.6273131	6.4999999
13	-25.2071514	5.9000000
14	-25.3677883	-0.4500000
15	-25.7374415	-0.6500000
16	-25.8415928	0.1000000
17	-26.4766302	12.6999999
18	-27.2476721	10.1999999
19	-28.2891641	-4.1500000
20	-29.3659115	17.5500000

MAIN LOBE NULL AND FIRST 20 SIDE-LOBES TO RIGHT OF (ABOVE) MAIN LOBE

RANK	REL. GAIN (DB)	TRUE ANGLE (DEG)	REL. ANGLE (DEG)
MAIN LOBE	** NULL **	3.4500000	
1	-12.9315119	3.6500000	0.6500000
2	-17.2201748	4.1000000	1.1000000
3	-18.6271539	4.6000000	1.6000000
4	-19.9463053	4.9000000	1.9000000
5	-24.0719504	5.4500000	2.4500000
6	-25.2071514	5.9000000	2.9000000
7	-24.6273131	6.4999999	3.5000000
8	-18.1365647	7.6999999	4.7000000
9	-30.9420934	9.0000000	6.0000001
10	-31.4118605	9.4499999	6.4500000
11	-31.4162097	9.5500000	6.5500000
12	-27.2476721	10.1999999	7.2000000
13	-33.1407375	10.9000000	7.9000000
14	-33.2485013	11.4499999	8.4499999
15	-26.4766302	12.6999999	9.6999999
16	-33.3815856	13.7499999	10.7499999
17	-34.6035342	14.1500000	11.1500000
18	-36.0675902	14.6500000	11.6500000
19	-35.6888623	15.1500000	12.1500000
20	-34.1877036	15.5999999	12.5999999

MAIN LOBE NULL AND FIRST 20 SIDE-LOBES TO LEFT OF (BELOW) MAIN LOBE

RANK	REL. GAIN (DB)	TRUE ANGLE (DEG)	REL. ANGLE (DEG)
MAIN LOBE	** NULL **	2.5000000	
1	-12.8041649	2.3500000	-0.6500000
2	-17.4370646	1.9000000	-1.1000000
3	-18.7666278	1.4000000	-1.6000000
4	-24.2982287	0.5500000	-2.4500000
5	-25.8415928	0.1000000	-2.9000000
6	-25.3677883	-0.4500000	-3.4500000
7	-25.7374415	-0.6500000	-3.6500000
8	-20.7159443	-1.7000000	-4.7000000
9	-31.5891590	-3.0500000	-6.0500000
10	-32.6192460	-3.5000000	-6.4999999
11	-28.2891641	-4.1500000	-7.1499999
12	-34.0846930	-4.8500000	-7.8500000

NO FURTHER SIDE LOBES ON THIS SIDE

SNUMB=4171T
1-23, Pass#1

* * * * ANTENNA LOBE SCANNER * * * *

THE MAIN LOBE GAIN IS 45.3075547

LOCATION AND RELATIVE GAIN OF HIGHEST 20 SIDE LOBES

RANK	REL. GAIN (DB)	ANGLE (DEG)
MAIN	0.0	2.0000000
1	-12.9362965	2.6500000
2	-12.9441814	1.3500000
3	-14.8226929	0.3500000
4	-16.2694435	3.6500000
5	-17.1349764	3.1000000
6	-17.2623854	0.9000000
7	-21.8583646	-1.3500000
8	-22.7438679	5.4000000
9	-23.3774176	-0.4500000
10	-23.7896094	4.4500000
11	-24.9378414	-0.9000000
12	-25.4495573	4.9000000
13	-26.7407475	-3.1500000
14	-27.2017274	32.4000001
15	-27.2725258	7.1500000
16	-27.6858468	9.1500000
17	-27.9687972	6.2499999
18	-28.0437083	-2.2500000
19	-28.1228499	6.7499999
20	-28.1240005	-5.0000000

MAIN LOBE NULL AND FIRST 20 SIDE-LOBES TO RIGHT OF (ABOVE) MAIN LOBE

RANK	REL. GAIN (DB)	TRUE ANGLE (DEG)	REL. ANGLE (DEG)
MAIN LOBE	** NULL **	2.4500000	
1	-12.9362965	2.6500000	0.6500000
2	-17.1349764	3.1000000	1.1000000
3	-16.2694435	3.6500000	1.6500000
4	-23.7896094	4.4500000	2.4500000
5	-25.4495573	4.9000000	2.9000000
6	-22.7438679	5.4000000	3.4000000
7	-27.9687972	6.2499999	4.2500000
8	-28.1228499	6.7499999	4.7500000
9	-27.2725258	7.1500000	5.1500000
10	-30.8247952	8.0500000	6.0500000
11	-27.6858468	9.1500000	7.1500000
12	-33.2294421	10.3499999	8.3499999
13	-32.1743531	11.2499999	9.2499999
14	-35.8339319	12.2499999	10.2499999
15	-33.1865144	13.0999999	11.0999999
16	-36.0003290	13.5500000	11.5500000
17	-36.9695959	14.0999999	12.0999999
18	-34.7104483	14.5999999	12.5999999
19	-34.9165044	14.8499999	12.8499999
20	-38.7324595	15.4000000	13.4000000

MAIN LOBE NULL AND FIRST 20 SIDE-LOBES TO LEFT OF (BELOW) MAIN LOBE

RANK	REL. GAIN (DB)	TRUE ANGLE (DEG)	REL. ANGLE (DEG)
MAIN LOBE	** NULL **	1.5500000	
1	-12.9441814	1.3500000	-0.6500000
2	-17.2623854	0.9000000	-1.1000000
3	-14.8226929	0.3500000	-1.6500000
4	-23.3774176	-0.4500000	-2.4500000
5	-24.9378414	-0.9000000	-2.9000000
6	-21.8583646	-1.3500000	-3.3500000
7	-28.0437083	-2.2500000	-4.2499999
8	-26.7407475	-3.1500000	-5.1500000
9	-30.3455691	-4.0500000	-6.0500000
10	-30.6853209	-4.5500000	-6.5500000

NO FURTHER SIDE LOBES ON THIS SIDE

SNUMB=7542T
3-06,Pass#1

• • • • ANTENNA LOBE SCANNER • • • •

THE MAIN LOBE GAIN IS 45.5178084

LOCATION AND RELATIVE GAIN OF HIGHEST 20 SIDE LOBES

RANK	REL. GAIN (DB)	ANGLE (DEG)
MAIN	0.0	0.9500000
1	-12.9336786	1.6000000
2	-12.9984999	0.3000000
3	-17.3619432	2.0500000
4	-17.4870453	-0.1500000
5	-18.6779509	2.5500000
6	-18.8758287	-0.6500000
7	-20.3417430	-0.9500000
8	-24.3401027	3.4000000
9	-24.6396527	-1.5000000
10	-25.3795252	4.4000000
11	-25.7958112	-2.5000000
12	-25.8784709	4.6000000
13	-25.9462366	3.8500000
14	-26.2940965	-1.9500000
15	-27.5813603	8.0999999
16	-28.9479351	6.2499999
17	-29.5239973	14.9499999
18	-29.5283923	5.2000000
19	-29.6630654	-4.3500000
20	-30.0547667	-3.3000000

MAIN LOBE NULL AND FIRST 20 SIDE-LOBES TO RIGHT OF (ABOVE) MAIN LOBE

RANK	REL. GAIN (DB)	TRUE ANGLE (DEG)	REL. ANGLE (DEG)
MAIN LOBE	•• NULL ••	1.4000000	
1	-12.9336786	1.6000000	0.6500000
2	-17.3619432	2.0500000	1.1000000
3	-18.6779509	2.5500000	1.6000000
4	-24.3401027	3.4000000	2.4500000
5	-25.9462366	3.8500000	2.9000000
6	-25.3795252	4.4000000	3.4500000
7	-25.6784709	4.6000000	3.6500000
8	-29.5283923	5.2000000	4.2500000
9	-30.4930916	5.6500000	4.7000000
10	-26.9479351	6.2499999	5.3000000
11	-32.8918452	6.9999999	6.0500000
12	-33.2652721	7.4999999	6.5500000
13	-27.5913603	8.0999999	7.1499999
14	-35.3629227	9.3000000	8.3500000
15	-33.3142381	9.8499999	8.9000000
16	-36.1176085	10.6500000	9.7000000
17	-36.1871257	11.1500000	10.2000000
18	-34.2686520	11.5999999	10.6500000
19	-34.6448048	11.9999999	11.0500000
20	-36.1995406	12.4999999	11.5500000

MAIN LOBE NULL AND FIRST 20 SIDE-LOBES TO LEFT OF (BELOW) MAIN LOBE

RANK	REL. GAIN (DB)	TRUE ANGLE (DEG)	REL. ANGLE (DEG)
MAIN LOBE	•• NULL ••	0.5000000	
1	-12.9984999	0.3000000	-0.6500000
2	-17.4870453	-0.1500000	-1.1000000
3	-18.8758287	-0.6500000	-1.6000000
4	-20.3417430	-0.9500000	-1.9000000
5	-24.6396527	-1.5000000	-2.4500000
6	-26.2940965	-1.9500000	-2.9000000
7	-25.7958112	-2.5000000	-3.4500000
8	-30.0547667	-3.3000000	-4.2500000
9	-31.1425605	-3.7500000	-4.7000000
10	-29.6630654	-4.3500000	-5.3000000

NO FURTHER SIDE LOBES ON THIS SIDE

SNUMB=2749T
1-21,Pass#1

**** ANTENNA LOBE SCANNER ****

THE MAIN LOBE GAIN IS 45.2987013.

LOCATION AND RELATIVE GAIN OF HIGHEST 20 SIDE LOBES

BANK	REL. GAIN (DB)	ANGLE (DEG)
MAIN	0.0	0.9500000
1	-12.7158108	0.3000000
2	-12.8724976	1.6000000
3	-16.8341303	-0.1500000
4	-17.1360111	2.0500000
5	-18.4243555	2.5500000
6	-18.5232530	-0.6500000
7	-20.5628166	7.6999999
8	-23.0474310	8.5500000
9	-23.7432332	-1.5000000
10	-24.0105276	3.4000000
11	-24.8879037	4.3500000
12	-25.1108494	-2.5000000
13	-25.5206466	3.8500000
14	-25.6071825	-1.9500000
15	-26.9224334	15.4000000
16	-27.7178550	6.1500000
17	-27.7554407	6.9000000
18	-27.9435573	6.6000000
19	-28.0817981	-4.2500000
20	-28.1378126	5.2000000

MAIN LOBE NULL AND FIRST 20 SIDE-LOBES TO RIGHT OF (ABOVE) MAIN LOBE

RANK	REL. GAIN (DB)	TRUE ANGLE (DEG)	REL. ANGLE (DEG)
MAIN LOBE	** NULL **	1.4000000	
1	-12.8724976	1.6000000	0.6500000
2	-17.1360111	2.0500000	1.1000000
3	-18.4243555	2.5500000	1.6000000
4	-24.0105276	3.4000000	2.4500000
5	-25.5206466	3.8500000	2.9000000
6	-24.8879037	4.3500000	3.4000000
7	-28.1378126	5.2000000	4.2500000
8	-29.1945610	5.7000000	4.7500000
9	-27.7178550	6.1500000	5.2000000
10	-27.9435573	6.6000000	5.6500000
11	-27.7554407	6.9000000	5.9500000
12	-20.5628166	7.6999999	6.7499999
13	-23.0474310	8.5500000	7.6000000
14	-30.6621485	9.3499999	8.4000000
15	-34.8648167	11.1500000	10.2000000
16	-33.4095721	11.5999999	10.6500000
17	-34.0189095	11.9999999	11.0500000
18	-35.4603829	12.4999999	11.5500000
19	-35.1353903	12.9499999	12.0000000
20	-33.6322370	13.4499999	12.5000000

MAIN LOBE NULL AND FIRST 20 SIDE-LOBES TO LEFT OF (BELOW) MAIN LOBE

RANK	REL. GAIN (DB)	TRUE ANGLE (DEG)	REL. ANGLE (DEG)
MAIN LOBE	** NULL **	0.5000000	
1	-12.7158108	0.3000000	-0.6500000
2	-16.8341303	-0.1500000	-1.1000000
3	-18.5232530	-0.6500000	-1.6000000
4	-23.7432332	-1.5000000	-2.4500000
5	-25.6071825	-1.9500000	-2.9000000
6	-25.1108494	-2.5000000	-3.4500000
7	-28.6913977	-3.2500000	-4.2000000
8	-29.2392578	-3.8000000	-4.7500000
9	-28.0817981	-4.2500000	-5.2000000
10	-28.4134462	-4.6500000	-5.6000000
11	-28.7493869	-4.9000000	-5.8500000

NO FURTHER SIDE LOBES ON THIS SIDE

SNUMB=2646T
5-07, Pass#1

• • • • ANTENNA LOBE SCANNER • • • •

THE MAIN LOBE GAIN IS 45.5214844

LOCATION AND RELATIVE GAIN OF HIGHEST 20 SIDE LOBES

RANK	REL. GAIN (DB)	ANGLE (DEG)
MAIN	0.0	0.9500000
1	-12.9566996	1.6000000
2	-13.0397501	0.3000000
3	-17.3801556	2.0500000
4	-17.4908304	-0.1500000
5	-18.6865082	2.5500000
6	-19.8793907	-0.6500000
7	-20.1321135	2.8500000
8	-20.3429904	-0.9500000
9	-24.3437490	3.4000000
10	-24.6498561	-1.5000000
11	-25.3926921	4.4000000
12	-25.7913504	-2.4500000
13	-25.9707303	3.8500000
14	-26.3281002	-1.9500000
15	-26.3384156	-2.7500000
16	-26.8836068	15.4000000
17	-27.5755557	8.0999999
18	-28.9474473	6.2499999
19	-29.5227213	5.2000000
20	-29.5592103	14.9499999

MAIN LOBE NULL AND FIRST 20 SIDE-LOBES TO RIGHT OF (ABOVE) MAIN LOBE

RANK	REL. GAIN (DB)	TRUE ANGLE (DEG)	REL. ANGLE (DEG)
MAIN LOBE	•• NULL ••	1.4000000	
1	-12.9566996	1.6000000	0.650[illegible]000
2	-17.3801556	2.0500000	1.1000000
3	-18.6865082	2.5500000	1.600[illegible]000
4	-20.1321135	2.8500000	1.900[illegible]000
5	-24.3437490	3.4000000	2.450[illegible]000
6	-25.9707303	3.8500000	2.900[illegible]000
7	-25.3926921	4.4000000	3.450[illegible]000
8	-29.5227213	5.2000000	4.250[illegible]000
9	-3[illegible].5044456	5.6500000	4.700[illegible]000
10	-28.9474473	6.2499999	5.300[illegible]000
11	-32.6741102	6.9999999	6.05[illegible]000
12	-33.8379846	7.2499999	6.300[illegible]000
13	-33.2087216	7.4499999	6.4999999
14	-27.5765657	8.0999999	7.1499999
15	-34.4611702	8.6000000	7.850[illegible]000
16	-35.3375354	9.2500000	8.300[illegible]001
17	-33.2897491	9.8000000	8.850[illegible]000
18	-33.5959450	10.0999999	9.150[illegible]000
19	-36.12[illegible]5292	10.6500000	9.700[illegible]000
20	-36.1445169	11.1500000	10.200[illegible]001

MAIN LOBE NULL AND FIRST 20 SIDE-LOBES TO LEFT OF (BELOW) MAIN LOBE

RANK	REL. GAIN (DB)	TRUE ANGLE (DEG)	REL. ANGLE (DEG)
MAIN LOBE	•• NULL ••	0.5000000	
1	-13.[illegible]397501	0.3000000	-0.650[illegible]000
2	-17.49[illegible]8304	-0.1500000	-1.100[illegible]000
3	-18.[illegible]793907	-0.6500000	-1.600[illegible]000
4	-2[illegible].3429904	-0.9500000	-1.900[illegible]000
5	-24.6498561	-1.5000000	-2.450[illegible]000
6	-26.[illegible]81[illegible]02	-1.9500000	-2.900[illegible]000
7	-25.7913504	-2.4500000	-3.400[illegible]000
8	-26.[illegible]384156	-2.7500000	-3.700[illegible]000
9	-3[illegible].[illegible]385670	-3.3000000	-4.250[illegible]000
10	-31.129477[illegible]	-3.7500000	-4.700[illegible]000
11	-29.6[illegible]74140	-4.3000000	-5.250[illegible]001

No FURTHER SIDE LOBES ON THIS SIDE

SNUMB=8415T
5-14,Pass#1

• • • • ANTENNA LOBE SCANNER • • • •

THE MAIN LOBE GAIN IS 45.4896536

LOCATION AND RELATIVE GAIN OF HIGHEST 20 SIDE LOBES

RANK	REL. GAIN (DB)	ANGLE (DEG)
MAIN	0.0	0.9500000
1	-12.9713039	1.6000000
2	-13.0046864	0.3000000
3	-17.0437965	2.0500000
4	-17.3399668	-0.1500000
5	-18.5267324	2.5500000
6	-18.7592630	-0.6500000
7	-20.0128393	2.8500000
8	-20.2436352	-0.9500000
9	-20.5804663	7.6999999
10	-23.4843521	6.5500000
11	-24.0202947	3.4000000
12	-24.1664543	-1.5000000
13	-24.9504261	4.3500000
14	-25.4865346	-2.4500000
15	-25.4955626	3.8500000
16	-25.5504098	4.6000000
17	-26.0685382	-1.9500000
18	-26.2704387	-2.7000000
19	-26.9386168	15.4000000
20	-27.8013349	6.1500000

MAIN LOBE NULL AND FIRST 20 SIDE-LOBES TO RIGHT OF (ABOVE) MAIN LOBE

RANK	REL. GAIN (DB)	TRUE ANGLE (DEG)	REL. ANGLE (DEG)
MAIN LOBE	•• NULL ••	1.4000000	
1	-12.9713039	1.6000000	0.6500000
2	-17.0437965	2.0500000	1.1000000
3	-18.5267324	2.5500000	1.6000000
4	-20.0128393	2.8500000	1.9000000
5	-24.0202947	3.4000000	2.4500000
6	-25.4955626	3.8500000	2.9000000
7	-24.9504261	4.3500000	3.4000000
8	-25.5504098	4.6000000	3.6500000
9	-28.2653609	5.2000000	4.2500000
10	-28.9569364	5.7000000	4.7500000
11	-27.8013349	6.1500000	5.2000000
12	-27.8671651	6.6000000	5.6500000
13	-27.8619738	6.8500000	5.9000000
14	-20.5804663	7.6999999	6.7499999
15	-23.4843521	8.5500000	7.6000000
16	-30.7614455	9.3499999	8.4000000
17	-30.7693696	9.4499999	8.5000000
18	-34.7207232	10.5999999	9.6500000
19	-35.4198217	11.1500000	10.2000000
20	-34.0019340	11.5999999	10.6500000

MAIN LOBE NULL AND FIRST 20 SIDE-LOBES TO LEFT OF (BELOW) MAIN LOBE

RANK	REL. GAIN (DB)	TRUE ANGLE (DEG)	REL. ANGLE (DEG)
MAIN LOBE	•• NULL ••	0.5000000	
1	-13.0046864	0.3000000	-0.6500000
2	-17.3399668	-0.1500000	-1.1000000
3	-18.7592630	-0.6500000	-1.6000000
4	-20.2436352	-0.9500000	-1.9000000
5	-24.1664543	-1.5000000	-2.4500000
6	-26.0685382	-1.9500000	-2.9000000
7	-25.4865346	-2.4500000	-3.4000000
8	-26.2704387	-2.7000000	-3.6500000
9	-29.0719171	-3.2500000	-4.2000000
10	-29.8747933	-3.7500000	-4.7500000
11	-28.4191 17	-4.2500000	-5.2000000
12	-28.675[illegible] 14	-4.7[illegible]0000	-5.6500000
13	-28.7142353	-4.9[illegible]0000	-5.8500000

No FURTHER SIDE LOBES ON THIS SIDE

SNUMB=2661T
5-07, Pass#1

• • • • ANTENNA LOBE SCANNER • • • •

THE MAIN LOBE GAIN IS 45.67652A

LOCATION AND RELATIVE GAIN OF HIGHEST 20 SIDE LOBES

RANK	REL. GAIN (DB)	ANGLE (DEG)
MAIN	0.0	0.9500000
1	-13.429[illegible]178	1.6000000
2	-13.5[illegible]81263	0.3000000
3	-17.925[illegible]307	2.0500000
4	-18.038[illegible]373	-0.1500000
5	-19.0555248	2.5500000
6	-19.2533379	-0.6500000
7	-20.5251389	2.8500000
8	-20.7369347	-0.9500000
9	-25.0[illegible]47522	3.4000000
10	-25.3[illegible]42965	-1.5000000
11	-25.818[illegible]275	4.4000000
12	-26.2222805	-2.4500000
13	-26.3256531	4.6000000
14	-26.6527014	3.8500000
15	-26.7587833	-2.7500000
16	-26.9256537	15.4000000
17	-27.0198698	-1.9500000
18	-27.7647924	8.0999999
19	-29.3778172	6.2499999
2[illegible]	-29.7655668	14.9499999

MAIN LOBE NULL AND FIRST 20 SIDE-LOBES TO RIGHT OF (ABOVE) MAIN LOBE

RANK	REL. GAIN (DB)	TRUE ANGLE (DEG)	REL. ANGLE (DEG)
MAIN LOBE	** NULL **	1.4000000	
1	-13.4260178	1.6000000	0.6500000
2	-17.9250307	2.0500000	1.1000000
3	-19.0555248	2.5500000	1.6000000
4	-20.5251389	2.8500000	1.9000000
5	-25.0047522	3.4000000	2.4500000
6	-26.6527 14	3.8500000	2.9000000
7	-25.8180275	4.4000000	3.4500000
8	-26.3256531	4.6000000	3.6500000
9	-30.2939854	5.2000000	4.2500000
10	-31.3024397	5.6500000	4.7000000
11	-29.3778172	6.2499999	5.3000000
12	-33.7920876	6.9999999	6.0500000
13	-34.1263981	7.4499999	6.4999999
14	-27.7647924	8.0999999	7.1499999
15	-35.3513 31	8.8000000	7.8500000
16	-36.2700834	9.2500000	8.3000001
17	-33.7737923	9.8000000	8.8500000
18	-34.0909605	10.0999999	9.1500000
19	-36.9668417	10.6500000	9.7000000
20	-36.9427652	11.1500000	10.2000000

MAIN LOBE NULL AND FIRST 20 SIDE-LOBES TO LEFT OF (BELOW) MAIN LOBE

RANK	REL. GAIN (DB)	TRUE ANGLE (DEG)	REL. ANGLE (DEG)
MAIN LOBE	** NULL **	0.5000000	
1	-13.5081263	0.3000000	-0.6500000
2	-18.0380373	-0.1500000	-1.1000000
3	-19.2533379	-0.6500000	-1.6000000
4	-20.7369347	-0.9500000	-1.9000000
5	-25.3042965	-1.5000000	-2.4500000
6	-27.0198698	-1.9500000	-2.9000000
7	-26.2222805	-2.4500000	-3.4000000
8	-26.7587833	-2.7500000	-3.7000000
9	-30.8093576	-3.3000000	-4.2500000
10	-31.9397650	-3.7500000	-4.7000000
11	-30.0744896	-4.3000000	-5.2500000

NO FURTHER SIDE LOBES ON THIS SIDE

SNUMB=7596T
5-06, Pass#1

• • • • ANTENNA LOBE SCANNER • • • •

THE MAIN LOBE GAIN IS 45.6725545

LOCATION AND RELATIVE GAIN OF HIGHEST 20 SIDE LOBES

RANK	REL. GAIN (DB)	ANGLE (DEG)
MAIN	0.0	0.9500000
1	-13.4 91104	1,6000000
2	-13.4999638	0,3000000
3	-17.8695063	2,0500000
4	-17.9991722	-0,1500000
5	-19.0473843	2,5500000
6	-19.2402554	-0,6500000
7	-20.510 842	2,8500000
8	-20.730858B	-0,9500000
9	-24,9879484	3,4000000
10	-25.2939482	-1,5000000
11	-25.8104029	4,4000000
12	-26.2153692	-2,4500000
13	-26.318349B	4,6000000
14	-26.638 281	3,8500000
15	-26.7558813	-2,7500000
16	-26,9274454	15,4000000
17	-27.0 79184	-1,9500000
18	-27,7495937	8,0999999
19	-29.3704615	6,2499999
20	-29,7635841	14,9499999

MAIN LOBE NULL AND FIRST 20 SIDE-LOBES TO RIGHT OF (ABOVE) MAIN LOBE

RANK	REL. GAIN (DB)	TRUE ANGLE (DEG)	REL. ANGLE (DEG)
MAIN LOBE	** NULL **	1.4000000	
1	-13.4051104	1.6000000	0.6500000
2	-17.8695 63	2.0500000	1.1000000
3	-19.0473843	2.5500000	1.6000000
4	-20.51 0842	2.8500000	1.9000000
5	-24.9879484	3.4000000	2.4500000
6	-26.6380281	3.8500000	2.9000000
7	-25.81 4 29	4.4000000	3.4500000
8	-26.3183498	4.6000000	3.6500000
9	-30.2783899	5.2000000	4.2500000
10	-31.2865917	5.6500000	4.7000000
11	-29.37 4615	6.2499999	5.3000000
12	-33.7483969	6.9999999	6.0500000
13	-33.9766788	7.4499999	6.4999999
14	-27.7495937	8.0999999	7.1499999
15	-35.2240896	8.8000000	7.8500000
16	-36.2271452	9.2500000	8.3000001
17	-33.7638931	9.8000000	8.8500000
18	-34.1825710	10.0999999	9.1500000
19	-36.9488945	10.6500000	9.7000000
20	-36.93 5456	11.1500000	10.2000000

MAIN LOBE NULL AND FIRST 20 SIDE-LOBES TO LEFT OF (BELOW) MAIN LOBE

RANK	REL. GAIN (DB)	TRUE ANGLE (DEG)	REL. ANGLE (DEG)
MAIN LOBE	** NULL **	0.5000000	
1	-13.4999638	0.3000000	-0.6500000
2	-17.9991722	-0.1500000	-1.1000000
3	-19.24 2554	-0.6500000	-1.6000000
4	-20.73 8588	-0.9500000	-1.9000000
5	-25.2939482	-1.5000000	-2.4500000
6	-27.1 72184	-1.9500000	-2.9000000
7	-28.2153692	-2.4500000	-3.4000000
8	-28.7558813	-2.7500000	-3.7000000
9	-30.7954521	-3.3000000	-4.2500000
10	-31.9225893	-3.7500000	-4.7000000
11	-33.5673466	-4.3000000	-5.2500000

NO FURTHER SIDE LOBES ON THIS SIDE

SNUMB=7478T
5-16, Pass#1

• • • • ANTENNA LOBE SCANNER • • • •

THE MAIN LOBE GAIN IS 27.5113397

LOCATION AND RELATIVE GAIN OF HIGHEST 20 SIDE LOBES

RANK	REL. GAIN (DB)	ANGLE (DEG)
MAIN	0.0	0.9500000
1	-2.4179893	15.4999999
2	-2.5291042	31.1499999
3	-5.8764405	30.1999998
4	-7.1596160	32.1999998
5	-12.9648924	1.6000000
6	-12.9734688	0.3000000
7	-16.1952119	14.4000000
8	-16.2600083	16.6499999
9	-17.298[illegible]251	29.3999999
10	-17.3439717	-0.1500000
11	-17.3596315	2.0500000
12	-17.4665236	33.0000000
13	-18.6[illegible]16941	2.5500000
14	-18.6092567	-0.6500000
15	-18.7315006	13.9000000
16	-18.8224468	17.1499999
17	-19.7478809	28.9499998
18	-19.9815393	-0.9500000
19	-19.9922085	2.8500000
20	-20.1955036	13.4499999

MAIN LOBE NULL AND FIRST 20 SIDE-LOBES TO RIGHT OF (ABOVE) MAIN LOBE

RANK	REL. GAIN (DB)	TRUE ANGLE (DEG)	REL. ANGLE (DEG)
MAIN LOBE	•• NULL ••	1.4000000	
1	-12.9648924	1.6000000	0.6500000
2	-17.3596315	2.0500000	1.1000000
3	-18.6016941	2.5500000	1.6000000
4	-19.9922085	2.8500000	1.9000000
5	-24.0703120	3.4000000	2.4500000
6	-25.5558371	3.8500000	2.9000000
7	-24.7677870	4.4000000	3.4500000
8	-25.1787148	4.6500000	3.7000000
9	-28.5997733	5.2000000	4.2500000
10	-29.2299409	5.6500000	4.7000000
11	-27.2774711	6.2499999	5.3000000
12	-30.6201596	6.9999999	6.0500000
13	-30.5573592	7.4499999	6.4999999
14	-24.2447600	8.1500000	7.2000000
15	-30.4030499	8.8000000	7.8500000
16	-30.5818605	9.3499999	8.4000000
17	-27.7533753	9.8499999	8.9000000
18	-27.7833452	9.9499999	9.0000000
19	-27.8197255	10.0999999	9.1500000
20	-29.2776437	10.6999999	9.7500000

MAIN LOBE NULL AND FIRST 20 SIDE-LOBES TO LEFT OF (BELOW) MAIN LOBE

RANK	REL. GAIN (DB)	TRUE ANGLE (DEG)	REL. ANGLE (DEG)
MAIN LOBE	•• NULL ••	0.5000000	
1	-12.9734688	0.3000000	-0.6500000
2	-17.3439717	-0.1500000	-1.1000000
3	-18.6092567	-0.6500000	-1.6000000
4	-19.9815393	-0.9500000	-1.9000000
5	-24.0859356	-1.5000000	-2.4500000
6	-25.5649886	-1.9500000	-2.9000000
7	-24.7480664	-2.4500000	-3.4000000
8	-25.1424208	-2.7500000	-3.7000000
9	-28.4824662	-3.3000000	-4.2500000
10	-29.2396212	-3.7500000	-4.7000000
11	-27.2838240	-4.3500000	-5.3000000

NO FURTHER SIDE LOBES ON THIS SIDE

SNUMB=8522T
5-08, Pass#1

• • • • ANTENNA LOBE SCANNER • • • •

THE MAIN LOBE GAIN IS 27.29 +177

LOCATION AND RELATIVE GAIN OF HIGHEST 20 SIDE LOBES

RANK	REL. GAIN (DB)	ANGLE (DEG)
MAIN	0.0	0.9500000
1	-2.4162817	15.4999999
2	-2.5144982	31.1499999
3	-5.8353839	30.1999998
4	-7.1772488	32.2500000
5	-12.7863779	1.6000000
6	-12.8343921	0.3000000
7	-15.8044491	14.4000000
8	-15.9701447	16.6499999
9	-16.8664536	-0.1500000
10	-16.9796360	2.0500000
11	-17.1[illegible]508	29.3999999
12	-17.2933317	33.0499997
13	-17.7106066	7.6999999
14	-18.2415919	-0.6500000
15	-18.2793303	23.0500000
16	-18.3392048	2.5500000
17	-18.3937810	13.9000000
18	-18.4994216	17.1499999
19	-19.2927208	22.3000000
20	-19.2961777	28.9499998

MAIN LOBE NULL AND FIRST 20 SIDE-LOBES TO RIGHT OF (ABOVE) MAIN LOBE

RANK	REL. GAIN (DB)	TRUE ANGLE (DEG)	REL. ANGLE (DEG)
MAIN LOBE	•• NULL ••	1.4000000	
1	-12.7863779	1.6000000	0.6500000
2	-16.9796360	2.0500000	1.1000000
3	-18.3392048	2.5500000	1.6000000
4	-19.4074487	2.8500000	1.9000000
5	-23.3069139	3.4000000	2.4500000
6	-24.6850409	3.8500000	2.9000000
7	-24.0437498	4.4000000	3.4500000
8	-24.3697534	4.6500000	3.7000000
9	-27.0157647	5.2000000	4.2500000
10	-27.3168278	5.7000000	4.7500000
11	-25.8819617	6.1500000	5.2000000
12	-25.5513377	6.6000000	5.6500000
13	-25.5763382	6.9499999	5.9999999
14	-17.7106066	7.6999999	6.7499999
15	-19.4323225	8.5500000	7.6000000
16	-25.5333424	9.4000000	8.4500000
17	-26.3975124	10.1500000	9.2000000
18	-27.4084406	10.6500000	9.7000000
19	-27.1784940	11.1500000	10.2000000
20	-25.0932465	11.6500000	10.7000000

MAIN LOBE NULL AND FIRST 20 SIDE-LOBES TO LEFT OF (BELOW) MAIN LOBE

RANK	REL. GAIN (DB)	TRUE ANGLE (DEG)	REL. ANGLE (DEG)
MAIN LOBE	•• NULL ••	0.5000000	
1	-12.8343921	0.3000000	-0.6500000
2	-16.8464536	-0.1500000	-1.1000000
3	-18.2415919	-0.6500000	-1.6000000
4	-23.6380315	-1.5000000	-2.4500000
5	-24.9736385	-1.9500000	-2.9000000
6	-24.2316478	-2.4500000	-3.4000000
7	-24.8484158	-2.7500000	-3.7000000
8	-27.1044990	-3.3000000	-4.2500000
9	-27.2272577	-3.8000000	-4.7500000
10	-26.0891144	-4.2500000	-5.2000000

NO FURTHER SIDE LOBES ON THIS SIDE

SNUMB=3575T
5-09,Pass#1

• • • • ANTENNA LOBE SCANNER • • • •

THE MAIN LOBE GAIN IS 27.2914271

LOCATION AND RELATIVE GAIN OF HIGHEST 20 SIDE LOBES

RANK	REL. GAIN (DB)	ANGLE (DEG)
MAIN	0.0	1.6000000
1	-2.4192479	15.5500000
2	-5.5127292	31.2499996
3	-5.8331240	36.2499998
4	-7.16[illegible]194	32.2999997
5	-12.5486333	1.6500000
6	-12.9831276	0.3500000
7	-14.0379620	16.6999998
8	-15.0726223	14.4499999
9	-17.0177989	33.0999999
10	-17.1475830	2.1000000
11	-17.1505623	29.4999998
12	-17.2502395	-0.1000000
13	-17.5143529	2.6000000
14	-17.6651447	-0.6000000
15	-17.6758863	7.3500000
16	-18.1487446	17.1999996
17	-18.1643774	13.9499999
18	-19.1183326	29.0500000
19	-19.3721125	22.5500000
20	-19.4695767	33.5499997

MAIN LOBE NULL AND FIRST 20 SIDE-LOBES TO RIGHT OF (ABOVE) MAIN LOBE

RANK	REL. GAIN (DB)	TRUE ANGLE (DEG)	REL. ANGLE (DEG)
MAIN LOBE	•• NULL ••	1.4500000	
1	-12.2485333	1.6500000	0.6500000
2	-17.1475830	2.1000000	1.1000000
3	-17.5193529	2.6000000	1.6000000
4	-23.3497801	3.4500000	2.4500000
5	-24.1723125	3.9000000	2.9000000
6	-23.5079641	4.4000000	3.4000000
7	-25.7813359	5.3000000	4.3000000
8	-25.2342556	5.7000000	4.7000000
9	-25.7387504	6.2499999	5.2499999
10	-25.0559401	6.4999999	5.4999999
11	-17.6735543	7.3500000	6.3500000
12	-23.3514524	8.1500000	7.1500000
13	-19.9730[illegible]82	9.0500000	8.0500000
14	-24.2605938	9.9000000	8.9000000
15	-26.2502[illegible]50	10.3000000	9.3000000
16	-25.3306729	10.7500000	9.7500000
17	-24.5930793	11.1500000	10.1500000
18	-24.6[illegible]29559	11.7499999	10.7499999
19	-23.9722283	12.0500000	11.3500000
20	-24.5528493	12.5500000	11.5500000

MAIN LOBE NULL AND FIRST 20 SIDE-LOBES TO LEFT OF (BELOW) MAIN LOBE

RANK	REL. GAIN (DB)	TRUE ANGLE (DEG)	REL. ANGLE (DEG)
MAIN LOBE	•• NULL ••	0.5500000	
1	-12.9831276	0.3500000	-0.6500000
2	-17.2[illegible]7.95	-0.1000000	-1.1000000
3	-17.6681447	-0.6000000	-1.6000000
4	-23.6666649	-1.4500000	-2.4500000
5	-24.6[illegible]9637	-1.9000000	-2.9000000
6	-23.3391419	-2.4000000	-3.4000000
7	-24.7723027	-3.7000000	-4.7000000
8	-25.4[illegible]7372	-4.2500000	-5.2500000

NO FURTHER SIDE LOBES ON THIS SIDE

SNUMB=3575T
5-09,Pass#5

• • • • ANTENNA LOBE SCANNER • • • •

THE MAIN LOBE GAIN IS 27.2837152

LOCATION AND RELATIVE GAIN OF HIGHEST 20 SIDE LOBES

RANK	REL. GAIN (DB)	ANGLE (DEG)
MAIN	0.0	4.9999999
1	-2.7421927	19.8499999
2	-3.7377357	19.4499998
3	-10.3487749	20.4499998
4	-12.7466478	5.6500000
5	-12.9298654	4.3500000
6	-14.6797900	18.7500000
7	-14.7679067	34.4499998
8	-16.7721853	7.9999999
9	-16.9291110	21.0500000
10	-17.1822166	3.9000000
11	-17.2293844	6.1000000
12	-18.3106785	2.0000000
13	-18.3212624	18.2500000
14	-18.3383527	6.6000000
15	-18.5134997	3.4000000
16	-18.9981365	22.5999999
17	-19.0057526	21.5500000
18	-19.4007225	17.7500000
19	-19.4139371	33.3499999
20	-19.5624905	23.2500000

MAIN LOBE NULL AND FIRST 20 SIDE-LOBES TO RIGHT OF (ABOVE) MAIN LOBE

RANK	REL. GAIN (DB)	TRUE ANGLE (DEG)	REL. ANGLE (DEG)
MAIN LOBE	** NULL **	5.4500000	
1	-12.7466478	5.6500000	0.6500000
2	-17.2293844	6.1000000	1.1000000
3	-18.3383527	6.6000000	1.6000000
4	-19.6621732	6.9000000	1.9000000
5	-22.3354607	7.4499999	2.4500000
6	-16.7721853	7.9999999	3.0000000
7	-23.5872664	8.6999999	3.7000000
8	-26.7387328	9.3000000	4.3000000
9	-27.2913327	9.6999999	4.7000000
10	-23.9396870	10.3499999	5.3500000
11	-23.1269554	11.0999999	6.1000000
12	-23.6901236	12.2499999	7.2499999
13	-24.4839196	13.4000000	8.4000001
14	-25.0424733	14.0999999	9.1000000
15	-27.7037826	14.9999999	10.0000000
16	-26.2326169	15.4999999	10.5000000
17	-20.0784783	16.4499998	11.4499999
18	-21.6340932	17.3499999	12.3500000
19	-19.4007225	17.7500000	12.7500001
20	-18.3212624	18.2500000	13.2500001

MAIN LOBE NULL AND FIRST 20 SIDE-LOBES TO LEFT OF (BELOW) MAIN LOBE

RANK	REL. GAIN (DB)	TRUE ANGLE (DEG)	REL. ANGLE (DEG)
MAIN LOBE	** NULL **	4.5500000	
1	-12.9298654	4.3500000	-0.6500000
2	-17.1822166	3.9000000	-1.1000000
3	-18.5134997	3.4000000	-1.6000000
4	-19.8117371	3.1000000	-1.9000000
5	-22.7326317	2.5500000	-2.4500000
6	-18.3106785	2.0000000	-3.0000000
7	-24.0254178	1.3000000	-3.7000000
8	-27.3179355	0.8000000	-4.1999999
9	-27.6219247	0.3000000	-4.6999999
10	-24.4929446	-0.2500000	-5.2499999
11	-23.9115783	-1.0500000	-6.0500000
12	-23.6921143	-2.1500000	-7.1499999
13	-23.6577282	-3.3000000	-8.3000000
14	-24.4453272	-3.9500000	-8.9499999
15	-27.1894817	-4.8000000	-9.8000000

NO FURTHER SIDE LOBES ON THIS SIDE

SNUMB=3575T
5-09,Pass#4

• • • • ANTENNA LOBE SCANNER • • • •

THE MAIN LOBE GAIN IS 27.2861724

LOCATION AND RELATIVE GAIN OF HIGHEST 20 SIDE LOBES

PAIR	REL. GAIN (DB)	ANGLE (DEG)
MAIN	0.0	4.0000000
1	-2.6253424	18.7500000
2	-3.734.064	35.0000000
3	-4.3695263	34.0000000
4	-12.8 32931	4.6500000
5	-13.0276029	3.3500000
6	-15.1986747	17.6499999
7	-15.6029248	33.1999996
8	-15.6481376	0.6500000
9	-15.6627817	19.9499996
1	-17.0139795	5.1000000
11	-17.1572070	2.9000000
12	-18.0772222	7.3500000
13	-18.2 92547	15.1999999
14	-18.3298746	17.1499999
15	-18.4333196	5.6000000
16	-18.4877439	32.7500000
17	-18.5206372	30.6000000
18	-18.5762248	2.4000000
19	-18.9611697	20.4499998
2	-19.5999804	16.6999996

MAIN LOBE NULL AND FIRST 20 SIDE-LOBES TO RIGHT OF (ABOVE) MAIN LOBE

PAIR	REL. GAIN (DB)	TRUE ANGLE (DEG)	REL. ANGLE (DEG)
MAIN LOBE	•• NULL ••	4.6500000	
1	-12.0038931	4.6500000	0.650 000
2	-17.129795	5.1000000	1.100 000
3	-18.4333196	5.6000000	1.600 000
4	-19.7097674	5.9000000	1.900 000
5	-23.2479873	6.4499999	2.450 000
6	-18.0992272	7.3500000	3.350 000
7	-24.9042136	8.3000000	4.300 000
8	-26.1765515	9.4000000	5.400 000
9	-28.7735547	10.0000000	6.000 001
1	-23.1959777	11.2499999	7.249999
11	-23.1873427	11.6500000	7.650 000
12	-25.8257198	12.9999996	8.999999
13	-25.5656556	14.0500000	10.050000
14	-18.2192547	15.1999999	11.199999
15	-22.2341883	16.2500000	12.250 000
16	-19.5999804	16.6999996	12.699999
17	-18.3255946	17.1499999	13.149999
18	-15.1986747	17.6499999	13.649999
19	-2.6253424	18.7500000	14.750 000
2	-16.6427817	19.9499996	15.949999

MAIN LOBE NULL AND FIRST 20 SIDE-LOBES TO LEFT OF (BELOW) MAIN LOBE

PAIR	REL. GAIN (DB)	TRUE ANGLE (DEG)	REL. ANGLE (DEG)
MAIN LOBE	•• NULL ••	3.5000000	
1	-13.0278729	3.3500000	-0.650 000
2	-17.1572 70	2.9000000	-1.100 000
3	-18.5762248	2.4000000	-1.600 000
4	-19.9063 13	2.1000000	-1.900 000
5	-23.4594844	1.5500000	-2.450 000
6	-16.6481376	0.6500000	-3.350 000
7	-24.4124927	-0.8000000	-4.800 000
8	-29.6991434	-1.4 00000	-5.400 000
9	-28.7735956	-2.0000000	-6.050 000
1	-27.1596822	-2.7500000	-6.749 999
11	-29.1 23359	-3.1000000	-7.100 000
12	-28.2152 04	-4.9000000	-8.900 000

20 FARTHER SIDE LOBES ( ) THIS SIDE

SNUMB=3575T
5-09,Pass#3

• • • • ANTENNA LOBE SCANNER • • • •

THE MAIN LOBE GAIN IS 27.2[illegible]46

LOCATION AND RELATIVE GAIN OF HIGHEST 20 SIDE LOBES

RANK	REL. GAIN (DB)	ANGLE (DEG)
MAIN	0.0	3.0000000
1	-2.513[illegible]277	17,6999998
2	-2,6074615	33,7500000
3	-4,[illegible]57899	32,7500000
4	-8,7522545	34,6499999
5	-12,8119221	2,3500000
6	-12,8413129	3,6500000
7	-15,5791443	16,5500000
8	-16,2541118	31,9499998
9	-16,5936825	18,8499999
10	-17,1[illegible]1351	4,1000000
11	-17,2214642	7,6999999
12	-17,3792605	1,9000000
13	-18,4261961	4,6000000
14	-18,5294156	-1,7000000
15	-18,5484853	1,4000000
16	-18,6286335	16,0500000
17	-18,8374228	19,3499999
18	-19,0806193	31,4499998
19	-19,277[illegible]119	22,2500000
20	-19,3403526	12,7499999

MAIN LOBE NULL AND FIRST 20 SIDE-LOBES TO RIGHT OF (ABOVE) MAIN LOBE

RANK	REL. GAIN (DB)	TRUE ANGLE (DEG)	REL. ANGLE (DEG)
MAIN LOBE	** NULL **	3.4500000	
1	-12.6413129	3.6500000	0.6500000
2	-17.1010351	4.1000000	1.1000000
3	-18.4261961	4.6000000	1.6000000
4	-19.7370558	4.9000000	1.9000000
5	-23.4965569	5.4500000	2.4500000
6	-24.6274210	5.9000000	2.9000000
7	-23.9865[illegible]97	6.4499999	3.4500000
8	-24.2567201	6.6500000	3.6500000
9	-17.2214642	7.6999999	4.7000000
10	-28.4800587	9.0500000	6.0500000
11	-28.4193501	9.4499999	6.4500000
12	-28.4574442	9.5500000	6.5500000
13	-23.6342910	10.1999999	7.2000000
14	-29.0390301	10.9500000	7.9000000
15	-29.2493107	11.0000000	8.0000000
16	-19.3403526	12.7499999	9.7499999
17	-24.3263130	13.8000000	10.8000000
18	-24.8920226	14.1999999	11.1999999
19	-24.9088659	14.6999999	11.6999999
20	-22.9943531	15.1999999	12.1999999

MAIN LOBE NULL AND FIRST 20 SIDE-LOBES TO LEFT OF (BELOW) MAIN LOBE

RANK	REL. GAIN (DB)	TRUE ANGLE (DEG)	REL. ANGLE (DEG)
MAIN LOBE	** NULL **	2.5500000	
1	-12.8119221	2.3500000	-0.6500000
2	-17.3792605	1.9000000	-1.1000000
3	-18.5484853	1.4000000	-1.6000000
4	-23.6179507	0.9500000	-2.4500000
5	-25.1037340	0.6000000	-2.9000000
6	-24.1762204	-0.4500000	-3.4500000
7	-24.3219558	-0.6500000	-3.6500000
8	-18.5294156	-1.7000000	-4.7000000
9	-28.6372848	-3.0500000	-6.0500000
10	-29.[illegible]42259	-3.5000000	-6.4999999
11	-29.[illegible]93168	-3.6000000	-6.6000000
12	-23.6243211	-4.1000000	-7.1499999
13	-28.[illegible]67344	-4.9000000	-7.8999999

NO FURTHER SIDE LOBES ON THIS SIDE

SNUMB=3575T
5-09, Pass#2

• • • • ANTENNA LOBE SCANNER • • • •

THE MAIN LOBE GAIN IS 27.29 3847

LOCATION AND RELATIVE GAIN OF HIGHEST 20 SIDE LOBES

RANK	REL. GAIN (DB)	ANGLE (DEG)
MAIN	0.0	2.0000000
1	-2.4603772	16.5999999
2	-2.5755873	32.5000000
3	-5.2451176	31.4999998
4	-7.75.5817	33.5499997
5	-12.8814564	1.3500000
6	-12.9386366	2.6500000
7	-15.0348773	0.3500000
8	-15.3737736	15.4999999
9	-15.6720754	3.6500000
10	-15.8299179	17.8000000
11	-15.9822423	30.6999998
12	-16.4211345	14.9499999
13	-16.7111540	34.3999996
14	-16.9267755	30.3499999
15	-16.9973479	0.9000000
16	-17.2723172	18.3000000
17	-17.2382755	3.1000000
18	-17.4722281	14.6500000
19	-18.4946463	29.5999999
20	-21.1785479	-1.4000000

MAIN LOBE NULL AND FIRST 20 SIDE-LOBES TO RIGHT OF (ABOVE) MAIN LOBE

RANK	REL. GAIN (DB)	TRUE ANGLE (DEG)	REL. ANGLE (DEG)
MAIN LOBE	•• NULL ••	2.4500000	
1	-12.9388368	2.6500000	0.6500000
2	-17.2382795	3.1000000	1.1000000
3	-19.6777954	3.6500000	1.6500000
4	-22.6539958	4.4500000	2.4500000
5	-24.3914571	4.9000000	2.9000000
6	-21.4411121	5.4000000	3.4000000
7	-26.4492123	6.2499999	4.2500000
8	-24.9463205	7.1500000	5.1500000
9	-23.1090326	7.9999999	6.0000000
10	-23.7240838	9.1999999	7.2000000
11	-27.8559159	10.4000000	8.4000000
12	-25.1343313	11.3000000	9.3000000
13	-26.7082275	12.3000000	10.3000000
14	-22.8994779	13.0999999	11.0999999
15	-24.7798573	13.5999999	11.5999999
16	-17.4722281	14.6500000	12.6500000
17	-16.4211845	14.9499999	12.9499999
18	-15.3737736	15.4999999	13.4999999
19	-2.4603772	16.5999999	14.5999999
20	-15.8299179	17.8000000	15.8000000

MAIN LOBE NULL AND FIRST 20 SIDE-LOBES TO LEFT OF (BELOW) MAIN LOBE

RANK	REL. GAIN (DB)	TRUE ANGLE (DEG)	REL. ANGLE (DEG)
MAIN LOBE	•• NULL ••	1.5500000	
1	-12.8814588	1.3500000	-0.6500000
2	-15.9973479	0.9000000	-1.1000000
3	-19.0348773	0.3500000	-1.6500000
4	-23.4712743	-0.4500000	-2.4500000
5	-25.1547211	-0.9 00000	-2.9000000
6	-21.1785479	-1.4000000	-3.4000000
7	-26.7145573	-2.2500000	-4.2499999
8	-24.6150146	-3.1500000	-5.1500000
9	-27.5485397	-4.0500000	-6.0500000

NO FURTHER SIDE LOBES ON THIS SIDE

SNUMB=8712T
5-08,Pass#1

• • • • ANTENNA LOBE SCANNER • • • •

THE MAIN LOBE GAIN IS 96.9826654

LOCATION AND RELATIVE GAIN OF HIGHEST 20 SIDE LOBES

RANK	REL. GAIN (DB)	ANGLE (DEG)
MAIN	0.0	0.9500000
1	-26.0666218	1.6000000
2	-26.1038284	0.3000000
3	-34.2516775	2.0000000
4	-34.9482164	-0.1000000
5	-40.8081312	2.5000000
6	-41.3501396	-0.6000000
7	-45.1560392	2.9500000
8	-45.7956123	-1.0500000
9	-48.8303165	3.4000000
10	-48.8942461	-1.5000000
11	-49.8733263	7.6999999
12	-51.6463060	15.4000000
13	-51.6609583	3.8500000
14	-52.8736649	-1.9500000
15	-53.6742058	4.3000000
16	-54.2353220	8.5500000
17	-54.6396017	14.9999999
18	-54.6734762	-2.4000000
19	-56.1660337	4.7499999
20	-56.7862787	5.1500000

MAIN LOBE NULL AND FIRST 20 SIDE-LOBES TO RIGHT OF (ABOVE) MAIN LOBE

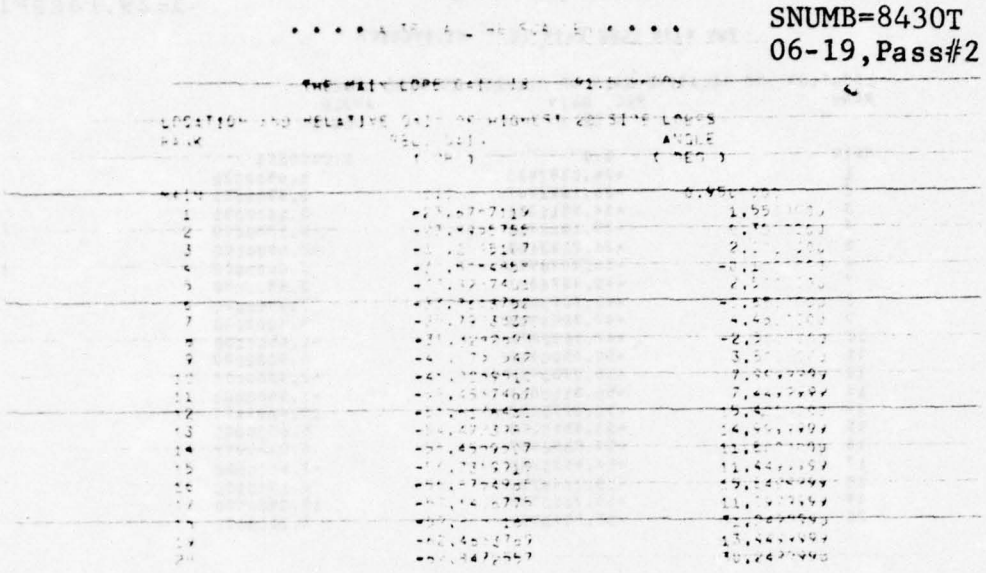
RANK	REL. GAIN (DB)	TRUE ANGLE (DEG)	REL. ANGLE (DEG)
MAIN LOBE	•• NULL ••	1.4500000	
1	-26.0666218	1.6000000	0.6500000
2	-34.2516775	2.0000000	1.0500000
3	-40.8081312	2.5000000	1.5500000
4	-45.1560392	2.9500000	2.0000000
5	-48.8303165	3.4000000	2.4500000
6	-51.6609583	3.8500000	2.9000000
7	-53.6742058	4.3000000	3.3500000
8	-56.1660337	4.7499999	3.8000000
9	-56.7862787	5.1500000	4.2000000
10	-58.3572598	5.9000000	4.9500000
11	-57.1964912	6.8000000	5.8500000
12	-49.8733263	7.6999999	6.7499999
13	-54.2353220	8.5500000	7.6000000
14	-63.5139732	9.3499999	8.4000000
15	-67.8198242	10.2500000	9.3000001
16	-69.3636065	10.5999999	9.6500000
17	-70.9153433	11.1500000	10.2000000
18	-71.8954372	11.5500000	10.6000000
19	-71.9993391	12.0500000	11.1000000
20	-72.2177820	12.4999999	11.5500000

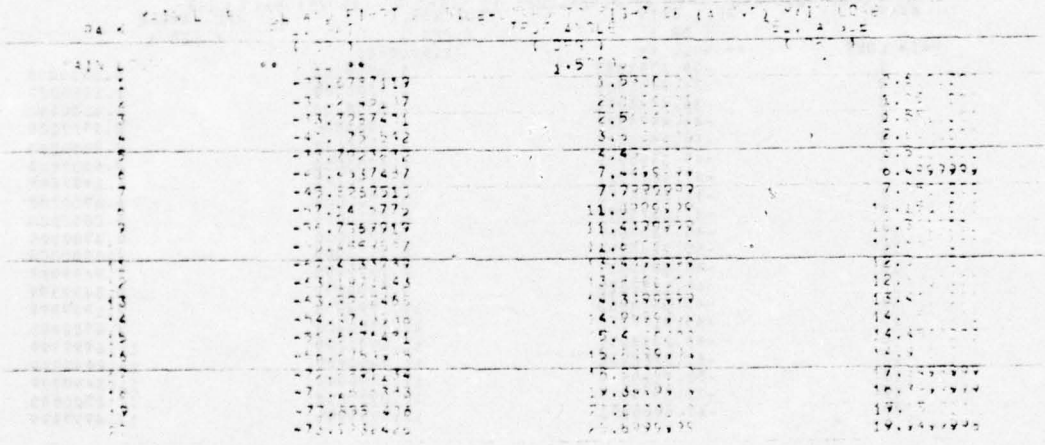
MAIN LOBE NULL AND FIRST 20 SIDE-LOBES TO LEFT OF (BELOW) MAIN LOBE

RANK	REL. GAIN (DB)	TRUE ANGLE (DEG)	REL. ANGLE (DEG)
MAIN LOBE	•• NULL ••	0.4500000	
1	-26.1038284	0.3000000	-0.6500000
2	-34.9482164	-0.1000000	-1.0500000
3	-41.3501396	-0.6000000	-1.5500000
4	-45.7956123	-1.0500000	-2.0000000
5	-48.8942461	-1.5000000	-2.4500000
6	-52.8736649	-1.9500000	-2.9000000
7	-54.6734762	-2.4000000	-3.3500000
8	-56.1294418	-2.8500000	-3.8000000
9	-56.4149742	-3.2500000	-4.2000000
10	-59.5294666	-4.0500000	-5.0000000
11	-58.7815491	-4.9000000	-5.8500000

NO FURTHER SIDE LOBES ON THIS SIDE

SNUMB=8430T
06-19, Pass#2





SNUMB=3732T
5-29.Pass#1

• • • • ANTENNA LOBE SCANNER • • • •

THE MAIN LOBE GAIN IS 91.5960197

LOCATION AND RELATIVE GAIN OF HIGHEST 20 SIDE LOBES

RANK	REL. GAIN (DB)	ANGLE (DEG)
MAIN	0.0	1.0000000
1	•26.0382833	1.6500000
2	•26.1622267	0.3500000
3	•34.9811382	2.1000000
4	•35.1812410	-0.1000000
5	•36.2163143	-0.6000000
6	•36.4496956	2.6000000
7	•48.4974327	3.4500000
8	•48.7085667	7.3500000
9	•49.3990908	4.4000000
10	•49.5082874	-1.4500000
11	•50.2500629	3.9000000
12	•50.2763987	-2.4000000
13	•50.8110867	-1.9500000
14	•52.6775875	15.4499999
15	•53.8558178	5.6500000
16	•54.8858957	8.9499999
17	•54.9535942	-3.6500000
18	•55.3048296	8.1500000
19	•55.7013588	15.0500000
20	•57.0573597	6.2000000

MAIN LOBE NULL AND FIRST 20 SIDE-LOBES TO RIGHT OF (ABOVE) MAIN LOBE

RANK	REL. GAIN (DB)	TRUE ANGLE (DEG)	REL. ANGLE (DEG)
MAIN LOBE	•• NULL ••	1.5000000	
1	-26.0382833	1.6500000	0.6500000
2	-34.9811382	2.1000000	1.1000000
3	-36.4496956	2.6000000	1.6000000
4	-48.4974327	3.4500000	2.4500000
5	-50.2500629	3.9000000	2.9000000
6	-49.3990908	4.4000000	3.4000000
7	-57.4847221	5.2499999	4.2499999
8	-93.8558178	5.6500000	4.6500000
9	-57.0573597	6.2000000	5.2000000
10	-48.7085667	7.3500000	6.3500000
11	-55.3048296	8.1500000	7.1500000
12	-54.8858557	8.9499999	7.9499999
13	-66.1152020	9.8499999	8.8499999
14	-65.8676863	10.1999999	9.1999999
15	-65.8178797	10.6500000	9.6500000
16	-68.2846251	11.6999999	10.6999999
17	-67.8466425	11.9999999	10.9999999
18	-70.7128019	12.3499999	11.3499999
19	-72.0573369	13.0500000	12.0500000
20	-67.8950653	13.4999999	12.4999999

MAIN LOBE NULL AND FIRST 20 SIDE-LOBES TO LEFT OF (BELOW) MAIN LOBE

RANK	REL. GAIN (DB)	TRUE ANGLE (DEG)	REL. ANGLE (DEG)
MAIN LOBE	•• NULL ••	0.5000000	
1	-26.1622267	0.3500000	-0.6500000
2	-35.1812410	-0.1000000	-1.1000000
3	-36.2163143	-0.6000000	-1.6000000
4	-49.5082874	-1.4500000	-2.4500000
5	-50.8110867	-1.9500000	-2.9500000
6	-50.2763987	-2.4000000	-3.4000000
7	-58.8643456	-3.2500000	-4.2500000
8	-54.9535942	-3.6500000	-4.6500000
9	-58.6245213	-4.2000000	-5.2000000

No FURTHER SIDE LOBES ON THIS SIDE

SNUMB=3732T
5-29, Pass#2

• • • • ANTENNA LOBE SCANNER • • • •

THE MAIN LOBE GAIN IS 91.0984230

LOCATION AND RELATIVE GAIN OF HIGHEST 20 SIDE LOBES

RANK	REL. GAIN (DB)	ANGLE (DEG)
MAIN	0.0	2.0000000
1	-13.5852003	0.3500000
2	-16.9246168	1.0000000
3	-17.7893343	1.3500000
4	-25.3000479	2.6500000
5	-26.7220535	3.7000000
6	-32.3995099	-1.3500000
7	-33.7192883	3.1000000
8	-37.1383023	-0.3000000
9	-37.5718284	5.3500000
10	-41.6713243	4.4999999
11	-41.9627337	-3.0000000
12	-44.3799043	7.0500000
13	-45.2296977	-2.2500000
14	-46.7913661	6.2499999
15	-49.3744941	-3.9000000
16	-49.6418691	7.9499999
17	-50.0995593	-4.7000000
18	-50.6817908	8.7500000
19	-51.6629291	30.3999999
20	-51.7154050	32.4499998

MAIN LOBE NULL AND FIRST 20 SIDE-LOBES TO RIGHT OF (ABOVE) MAIN LOBE

RANK	REL. GAIN (DB)	TRUE ANGLE (DEG)	REL. ANGLE (DEG)
MAIN LOBE	•• NULL ••	2.5000000	
1	-25.3000479	2.6500000	0.6500000
2	-33.7192883	3.1000000	1.1000000
3	-26.7220535	3.7000000	1.7000000
4	-41.6713243	4.4999999	2.5000000
5	-37.5718284	5.3500000	3.3500000
6	-46.7913661	6.2499999	4.2500000
7	-44.3799043	7.0500000	5.0500000
8	-49.6418691	7.9499999	5.9500000
9	-50.6817908	8.7500000	6.7500001
10	-52.2115121	9.5999999	7.6000000
11	-55.8265767	10.4000000	8.4000000
12	-53.6677060	11.3000000	9.3000000
13	-61.0627646	12.0500000	10.0500000
14	-54.8582520	13.0500000	11.0500000
15	-55.5122752	14.4000000	12.4000000
16	-51.9100146	14.8000000	12.8000000
17	-55.8025813	15.1999999	13.1999999
18	-70.9027805	16.3499999	14.3499999
19	-68.2287655	16.8000000	14.8000000
20	-71.4153032	17.3000000	15.3000000

MAIN LOBE NULL AND FIRST 20 SIDE-LOBES TO LEFT OF (BELOW) MAIN LOBE

RANK	REL. GAIN (DB)	TRUE ANGLE (DEG)	REL. ANGLE (DEG)
MAIN LOBE	•• NULL ••	1.5000000	
1	-17.7893343	1.3500000	-0.6500000
2	-16.9246168	1.0000000	-1.0000000
3	-13.5852003	0.3500000	-1.6500000
4	-37.1383023	-0.3000000	-2.3000000
5	-32.3995099	-1.3500000	-3.3500000
6	-45.2296977	-2.2500000	-4.2499999
7	-41.9627337	-3.0000000	-4.9999999
8	-49.3744941	-3.9000000	-5.9000000
9	-50.0995593	-4.7000000	-6.6999999

NO FURTHER SIDE LOBES ON THIS SIDE

SNUMB=3765T
2-19,Pass#1

• • • • ANTENNA LOBE SCANNER • • • •

THE MAIN LOBE GAIN IS 91.4039429

LOCATION AND RELATIVE GAIN OF HIGHEST 20 SIDE LOBES

RANK	REL. GAIN (DB)	ANGLE (DEG)
MAIN	0.0	0.9500000
1	-25.4287643	0.3000000
2	-25.4585829	1.5500000
3	-34.2078018	2.0500000
4	-37.3320942	2.5500000
5	-37.6329222	-0.6500000
6	-47.7754259	-1.5000000
7	-48.2605524	3.4000000
8	-49.6163158	7.6999999
9	-50.4163465	4.3500000
10	-50.9727116	-2.5000000
11	-51.3043976	3.8500000
12	-51.5849543	-1.9000000
13	-53.0992708	8.5000000
14	-54.4399223	14.9999999
15	-56.2053366	5.1500000
16	-56.9352055	6.1000000
17	-56.9948692	6.8000000
18	-57.6355648	-4.2000000
19	-58.8070431	-4.8500000
20	-63.3834143	9.3499999

MAIN LOBE NULL AND FIRST 20 SIDE-LOBES TO RIGHT OF (ABOVE) MAIN LOBE

RANK	REL. GAIN (DB)	TRUE ANGLE (DEG)	REL. ANGLE (DEG)
MAIN LOBE	** NULL **	1.5000000	
1	-25.4585829	1.5500000	0.6000000
2	-34.2078018	2.0500000	1.1000000
3	-37.3320942	2.5500000	1.6000000
4	-48.2605524	3.4000000	2.4500000
5	-51.3043976	3.8500000	2.9000000
6	-50.4163465	4.3500000	3.4000000
7	-56.2053366	5.1500000	4.2000000
8	-56.9352055	6.1000000	5.1500000
9	-56.9948692	6.8000000	5.8500000
10	-49.6163158	7.6999999	6.7499999
11	-53.0992708	8.5000000	7.5500000
12	-63.3834143	9.3499999	8.4000000
13	-64.9997416	10.1500000	9.2000000
14	-69.4696217	11.1999999	10.2500000
15	-67.2222033	11.6500000	10.7000000
16	-68.1311665	11.9499999	11.0000000
17	-71.0880833	12.4999999	11.5500000
18	-70.2191401	12.9999999	12.0500000
19	-67.5275393	13.4499999	12.5000000
20	-67.4474712	13.8499999	12.9000000

MAIN LOBE NULL AND FIRST 20 SIDE-LOBES TO LEFT OF (BELOW) MAIN LOBE

RANK	REL. GAIN (DB)	TRUE ANGLE (DEG)	REL. ANGLE (DEG)
MAIN LOBE	** NULL **	0.4000000	
1	-25.4287643	0.3000000	-0.6500000
2	-37.6329222	-0.6500000	-1.6000000
3	-47.7754259	-1.5000000	-2.4500000
4	-51.5849543	-1.9000000	-2.8500000
5	-50.9727116	-2.5000000	-3.4500000
6	-57.6355648	-4.2000000	-5.1500000
7	-58.8070431	-4.8500000	-5.8000000

NO FURTHER SIDE LOBES ON THIS SIDE

SNUMB=7468T
5-08, Pass#1

• • • • ANTENNA LOBE SCANNER • • • •

THE MAIN LOBE GAIN IS 91.5894156

LOCATION AND RELATIVE GAIN OF HIGHEST 20 SIDE LOBES

RANK	REL. GAIN (DB)	ANGLE (DEG)
MAIN	0.0	0.9500000
1	-26.0064497	1.6000000
2	-26.0449476	0.3000000
3	-34.0812292	2.0000000
4	-34.7594805	-0.1000000
5	-37.5037069	2.5500000
6	-37.9344568	-0.6500000
7	-48.3997517	3.4000000
8	-48.510 393	-1.5000000
9	-49.7387686	7.6999999
1	-50.5 19617	4.4000000
11	-51.3000469	3.8500000
12	-51.5 71487	-2.4500000
13	-51.6452904	15.4000000
14	-51.6556263	4.6000000
15	-52.474 219	-1.9500000
16	-53.6536570	8.5000000
17	-54.639 486	14.9999999
18	-56.4693995	5.1500000
19	-56.8878470	15.8499999
2	-57.0143080	6.8000000

MAIN LOBE NULL AND FIRST 20 SIDE-LOBES TO RIGHT OF (ABOVE) MAIN LOBE

RANK	REL. GAIN (DB)	TRUE ANGLE (DEG)	REL. ANGLE (DEG)
MAIN LOBE	•• NULL ••	1.4500000	
1	-26.0064497	1.6000000	0.6500000
2	-34.0812292	2.0000000	1.0500000
3	-37.5037 69	2.5500000	1.600.000
4	-48.3997517	3.4000000	2.450.000
5	-51.3000469	3.8500000	2.900.000
6	-5 .5019617	4.4000000	3.450.000
7	-51.6556263	4.6000000	3.650.000
8	-56.4693995	5.1500000	4.200.000
9	-58.5366 56	5.7499999	4.800.000
1	-57.1173935	6.1000000	5.150.000
11	-57.0143 80	6.8000000	5.850.000
12	-49.7387686	7.6999999	6.7499999
13	-53.6536570	8.5000000	7.5500000
14	-63.3744755	9.3499999	8.4000000
15	-63.4181690	9.4499999	8.5000000
16	-65.4044848	10.1500000	9.2000000
17	-68.9583289	10.5999999	9.650.000
18	-7 .3941860	11.1500000	10.2000000
19	-68.0884237	11.5999999	10.6500000
2	-68.6140289	11.9499999	11.000.000

MAIN LOBE NULL AND FIRST 20 SIDE-LOBES TO LEFT OF (BELOW) MAIN LOBE

RANK	REL. GAIN (DB)	TRUE ANGLE (DEG)	REL. ANGLE (DEG)
MAIN LOBE	•• NULL ••	0.4500000	
1	-26.0449476	0.3000000	-0.650.000
2	-34.7594805	-0.1000000	-1.050.000
3	-37.9344568	-0.6500000	-1.600.000
4	-48.5 0393	-1.5000000	-2.450.000
5	-52.4740219	-1.9500000	-2.900.000
6	-51.5071487	-2.4500000	-3.400.000
7	-58. 472 59	-3.2500000	-4.200.000
8	-6 .2525236	-3.8000000	-4.750.000
9	-58.1115112	-4.2000000	-5.150.000
1	-58.6125650	-4.9000000	-5.850.000

NO FURTHER SIDE LOBES ON THIS SIDE

SNUMB=3590T
5-07, Pass#1

* * * * ANTENNA LOBE SCANNER * * * *

THE MAIN LOBE GAIN IS 94.4041138

LOCATION AND RELATIVE GAIN OF HIGHEST 20 SIDE LOBES

RANK	REL. GAIN (DB)	ANGLE (DEG)
MAIN	0.0	0.9500000
1	-25.2950783	1.5500000
2	-25.6395798	0.3000000
3	-33.6926465	2.0000000
4	-37.4550595	2.5500000
5	-37.4968895	-0.6500000
6	-47.5103965	3.4000000
7	-48.6561856	-1.5000000
8	-49.6474443	7.6999999
9	-50.1221690	4.4000000
10	-50.4528909	3.6500000
11	-51.2186065	-2.4500000
12	-51.5714927	15.4000000
13	-51.7110171	-1.9500000
14	-53.3004875	8.5000000
15	-54.5120125	14.9999999
16	-56.2282033	5.1500000
17	-56.6609893	6.1500000
18	-56.8073106	6.7499999
19	-56.8201480	15.8499999
20	-57.2254500	-3.2500000

MAIN LOBE NULL AND FIRST 20 SIDE-LOBES TO RIGHT OF (ABOVE) MAIN LOBE

RANK	REL. GAIN (DB)	TRUE ANGLE (DEG)	REL. ANGLE (DEG)
MAIN LOBE	** NULL **	1.5000000	
1	-25.2950783	1.5500000	0.6000000
2	-33.6926465	2.0000000	1.0500000
3	-37.4550595	2.5500000	1.6000000
4	-47.5103965	3.4000000	2.4500000
5	-50.4528909	3.6500000	2.9000000
6	-50.1221690	4.4000000	3.4500000
7	-56.2282033	5.1500000	4.2000000
8	-57.9623609	5.7000000	4.7500000
9	-56.6609893	6.1500000	5.2000000
10	-56.8073106	6.7499999	5.8000000
11	-49.6474443	7.6999999	6.7499999
12	-53.3004870	8.5000000	7.5500000
13	-62.7252059	9.3499999	8.4000000
14	-65.4245472	10.1500000	9.2000000
15	-67.8767443	10.5999999	9.6500000
16	-69.4951878	11.1500000	10.2000000
17	-67.9285603	11.5999999	10.6500000
18	-68.3380470	11.9499999	11.0000000
19	-71.0148697	12.4999999	11.5500000
20	-70.9014616	12.9999999	12.0500000

MAIN LOBE NULL AND FIRST 20 SIDE-LOBES TO LEFT OF (BELOW) MAIN LOBE

RANK	REL. GAIN (DB)	TRUE ANGLE (DEG)	REL. ANGLE (DEG)
MAIN LOBE	** NULL **	0.4000000	
1	-25.6395798	0.3000000	-0.6500000
2	-37.4968895	-0.6500000	-1.6000000
3	-48.6561856	-1.5000000	-2.4500000
4	-51.7110171	-1.9500000	-2.9000000
5	-51.2186065	-2.4500000	-3.4000000
6	-57.2254500	-3.2500000	-4.2000000
7	-58.0714040	-4.1500000	-5.1000000
8	-58.4516978	-4.9000000	-5.8500000

NO FURTHER SIDE LOBES ON THIS SIDE

SNUMB=7546T
5-30, Pass#1

**** ANTENNA PATTERN SUMMARY ****

THE MAIN BEAM GAIN IS 34.503.038

LOCATION AND RELATIVE GAIN OF HIGHEST 20 SIDE LOBES

PEAK	REL. GAIN (DB)	ANGLE (DEG)
MAIN	0.0	0.950000
1	-26.109378	1.60 0000
2	-26.203731[illegible]	0.30 0000
3	-35.069[illegible]	2.05 0000
4	-35.331[illegible]	-0.15 0000
5	-37.84[illegible]	2.55 0000
6	-38.25[illegible]	-0.65 0000
7	-41.00[illegible]	2.85 0000
8	-41.44[illegible]	-0.95 0000
9	-48.13[illegible]	3.40 0000
10	-48.71[illegible]	-1.50 0000
11	-51.36[illegible]	4.35 0000
12	-51.64[illegible]	15.40 0000
13	-52.14[illegible]	-2.45 0000
14	-52.31[illegible]	3.65 0000
15	-52.51[illegible]	4.60 0000
16	-53.00[illegible]	-1.95 0000
17	-53.43[illegible]	-2.70 0000
18	-54.65[illegible]	14.99[illegible]999
19	-55.36[illegible]	8.00 9999
20	-56.88[illegible]	13.84 9999

MAIN LOBE NULL AND START OF SIDE-LOBES TO RIGHT OF (ABOVE) MAIN LOBE

PEAK	REL. GAIN (DB)	ZERO ANGLE (DEG)	REL. ANGLE (DEG)
MAIN LOBE	** NULL **	1.450000	
1	-28.1009378	1.6000 00	0.6500000
2	-35.069[illegible]	2.0500 00	1.1000000
3	-37.84[illegible]	2.5500 00	1.6000000
4	-41.004[illegible]	2.8500 00	1.9000000
5	-48.132[illegible]	3.4000 00	2.4500000
6	-52.310[illegible]	3.8500 00	2.9000000
7	-51.363[illegible]	4.3500 00	3.4000000
8	-52.511[illegible]	4.6000 00	3.6500000
9	-59.26[illegible]	5.2000 00	4.2500000
10	-61.064[illegible]	5.6500 00	4.7000000
11	-58.456[illegible]	6.2000 00	5.2500000
12	-65.355[illegible]	6.9999-09	6.0500000
13	-66.910[illegible]	7.2499-09	6.3000000
14	-65.96[illegible]	7.4999-09	6.5500000
15	-55.360[illegible]	8.0999-09	7.1499999
16	-68.735[illegible]	8.8000 00	7.8500000
17	-70.464[illegible]	9.2500 00	8.1000000
18	-70.228[illegible]	9.3000 00	8.3500000
19	-66.839[illegible]	9.5500 00	8.6000000
20	-66.716[illegible]	9.8000 00	8.8500000

MAIN LOBE NULL AND START OF SIDE-LOBES TO LEFT OF (BELOW) MAIN LOBE

PEAK	REL. GAIN (DB)	ZERO ANGLE (DEG)	REL. ANGLE (DEG)
MAIN LOBE	** NULL **	0.450000	
1	-26.2037315	0.3000 00	-0.6500000
2	-35.33[illegible]	-0.1500 00	-1.1000000
3	-38.25[illegible]	-0.6500 00	-1.6000000
4	-41.44[illegible]	-0.9500 00	-1.9000000
5	-48.71[illegible]	-1.5000 00	-2.4[illegible]
6	-53.00[illegible]	-1.9501 [illegible]	-2.9[illegible]
7	-50.14[illegible]	-2.4501 [illegible]	-3.4000000
8	-53.43[illegible]	-2.7001 [illegible]	-3.6500000
9	-51.32[illegible]	-3.3001 [illegible]	-4.2500000
10	-52.20[illegible]	-3.7501 [illegible]	-4.7000000
11	-59.92[illegible]	-4.2501 [illegible]	-5.2000000

NO FURTHER SIDE LOBES ON THIS SIDE

• • • • ANTENNA LOBE SCANNER • • • •

SNUMB=7462T
06-17, Pass#1

THE MAIN LOBE GAIN IS 91.5956818

LOCATION AND RELATIVE GAIN OF HIGHEST 20 SIDE LOBES

RANK	REL. GAIN (DB)	ANGLE (DEG)
MAIN	0.0	2.0000000
1	-26.0259552	1.3500000
2	-26.1778134	2.6500000
3	-32.2269335	0.3500000
4	-33.8849640	3.6500000
5	-34.7722073	0.9000000
6	-35.2179823	3.1000000
7	-46.4151753	-1.3500000
8	-47.0176003	5.4000000
9	-47.9498157	4.4500000
10	-48.8347768	-0.4500000
11	-51.9875833	32.4499998
12	-51.9836866	-0.9000000
13	-52.2309713	4.9000000
14	-54.1929227	31.4499998
15	-54.9821907	-3.0500000
16	-55.3995178	7.1000000
17	-56.1631239	6.2499999
18	-56.1935902	9.1500000
19	-57.0056057	-2.2500000
20	-57.0400057	-5.0000000

MAIN LOBE NULL AND FIRST 20 SIDE-LOBES TO RIGHT OF (ABOVE) MAIN LOBE

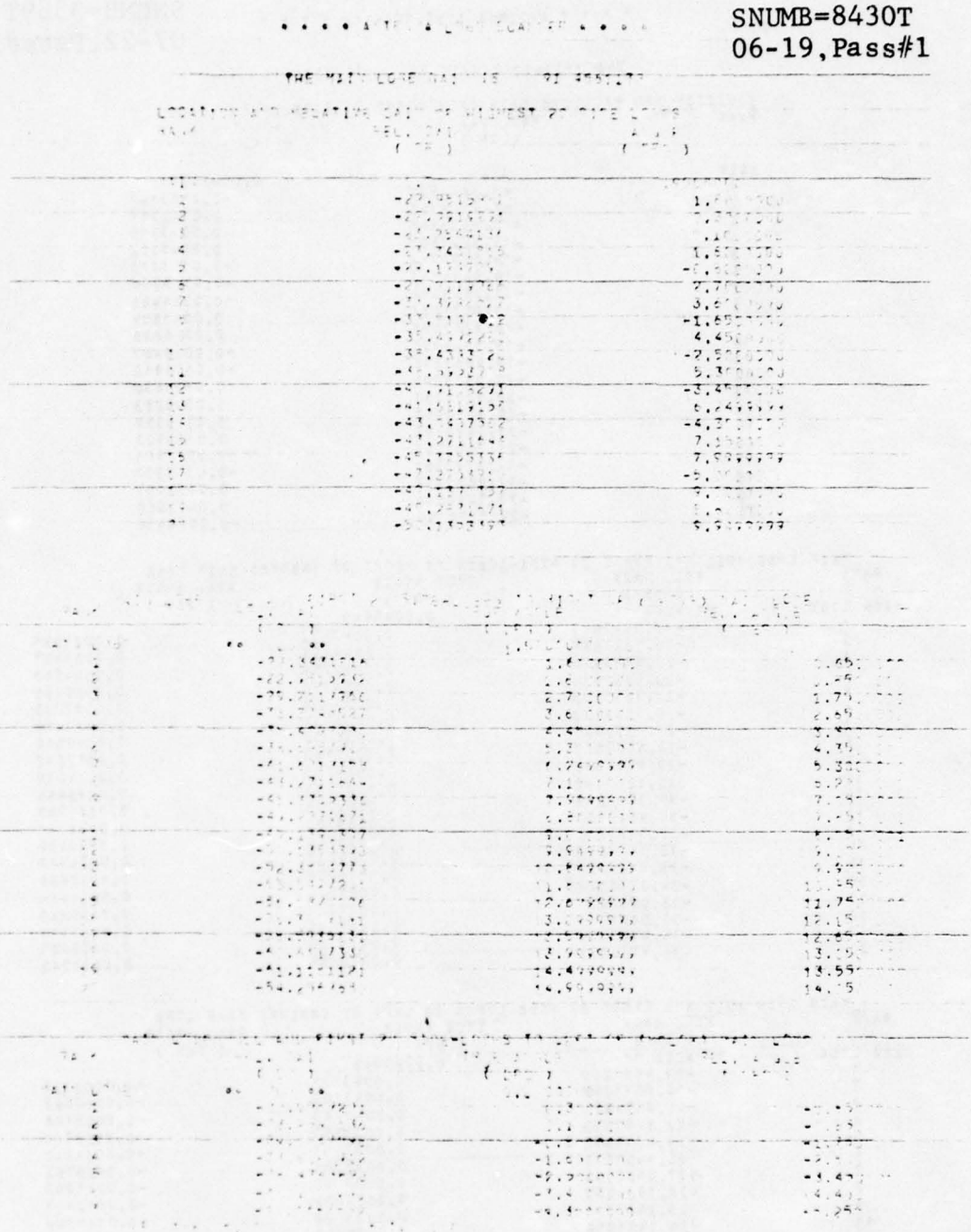
RANK	REL. GAIN (DB)	TRUE ANGLE (DEG)	REL. ANGLE (DEG)
MAIN LOBE	•• NULL ••	2.5000000	
1	-26.1778134	2.6500000	0.6500000
2	-35.2179823	3.1000000	1.1000000
3	-33.8849640	3.6500000	1.6500000
4	-47.9498157	4.4500000	2.4500000
5	-52.2309713	4.9000000	2.9000000
6	-47.0176003	5.4000000	3.4000000
7	-56.1551239	6.2499999	4.2500000
8	-55.3995178	7.1000000	5.1000000
9	-60.9042702	7.9000000	5.9000000
10	-62.5899567	8.5999999	6.6000000
11	-56.1935902	9.1500000	7.1500000
12	-68.8617561	10.1500000	8.1500000
13	-67.4010502	10.3499999	8.3499999
14	-67.7934425	10.5999999	8.5999999
15	-67.1977606	10.9000000	8.9000000
16	-65.5184588	11.2499999	9.2499999
17	-72.8025657	12.1999999	10.1999999
18	-73.1557474	12.4000000	10.4000000
19	-69.7171221	12.7499999	10.7499999
20	-68.2218746	13.0500000	11.0500000

MAIN LOBE NULL AND FIRST 20 SIDE-LOBES TO LEFT OF (BELOW) MAIN LOBE

RANK	REL. GAIN (DB)	TRUE ANGLE (DEG)	REL. ANGLE (DEG)
MAIN LOBE	•• NULL ••	1.5000000	
1	-26.0259552	1.3500000	-0.6500000
2	-34.7722073	0.9000000	-1.1000000
3	-32.2269335	0.3500000	-1.6500000
4	-48.8347768	-0.4500000	-2.4500000
5	-51.9836866	-0.9000000	-2.9000000
6	-46.4151753	-1.3500000	-3.3500000
7	-57.0056057	-2.2500000	-4.2499994
8	-54.9821907	-3.0500000	-5.0500001
9	-61.4374411	-3.9500000	-5.9500001
10	-61.5719328	-4.0000000	-5.9999994

NO FURTHER SIDE LOBES ON THIS SIDE

SNUMB=8430T
06-19,Pass#1



SNUMB=3389T
07-22,Pass#1

* * * * ANTENNA LOBE SCANNER * * * *

THE MAIN LOBE GAIN IS 30.0274816

LOCATION AND RELATIVE GAIN OF HIGHEST 20 SIDE LOBES

RANK	REL. GAIN (DB)	ANGLE (DEG)
MAIN	0.0	0.0045471
1	-1.3844624	-0.01 3149
2	-7.4706366	0.0193787
3	-13.4691548	0.00-3335
4	-13.5447807	0.00-7302
5	-14.6061344	-0.01 1013
6	-14.8436485	-0.01 5286
7	-17.9545498	-0.0251465
8	-18.0071068	0.00-1809
9	-18.1287599	0.00-8828
10	-19.11-9130	-0.00-9487
11	-19.4661136	-0.01 6812
12	-20.5273795	0.0131650
13	-20.8074951	0.00-0283
14	-20.9712996	0.0050354
15	-21.0898099	0.0155923
16	-21.9583702	-0.0067961
17	-22.5747981	-0.01 8337
18	-22.8492928	0.0038757
19	-23.0487814	0.0051880
20	-24.0554190	-0.0096436

MAIN LOBE NULL AND FIRST 20 SIDE-LOBES TO RIGHT OF (ABOVE) MAIN LOBE

RANK	REL. GAIN (DB)	TRUE ANGLE (DEG)	REL. ANGLE (DEG)
MAIN LOBE	** NULL **	0.0046692	
1	-13.5447807	0.0047702	0.0001831
2	-18.1287599	0.0048628	0.0003357
3	-20.9712996	0.0050054	0.0004883
4	-23.0487814	0.0051580	0.0006409
5	-24.7613156	0.0053106	0.0007935
6	-26.1541643	0.0054632	0.0009460
7	-27.4194727	0.0056158	0.0010986
8	-28.5873047	0.0057683	0.0012512
9	-29.6958852	0.0059209	0.0014038
10	-30.8243442	0.0061 35	0.0015564
11	-31.3916586	0.0062756	0.0016785
12	-31.9643657	0.0063782	0.0018311
13	-32.5453310	0.0065308	0.0019836
14	-33.1443699	0.0066833	0.0021362
15	-33.812-199	0.0068 59	0.0022888
16	-34.3715324	0.0069685	0.0024414
17	-35.0650421	0.0071411	0.0025940
18	-35.5471311	0.0072632	0.0027161
19	-35.8163824	0.0074158	0.0028687
20	-36.1754923	0.0075684	0.0030212

MAIN LOBE NULL AND FIRST 20 SIDE-LOBES TO LEFT OF (BELOW) MAIN LOBE

RANK	REL. GAIN (DB)	TRUE ANGLE (DEG)	REL. ANGLE (DEG)
MAIN LOBE	** NULL **	0.0043945	
1	-13.4691548	0.0043335	-0.0002136
2	-18.0071068	0.0041809	-0.0003662
3	-20.8074951	0.0040283	-0.0005188
4	-22.8492928	0.0038757	-0.0006714
5	-24.4318495	0.0037231	-0.0008240
6	-25.8401670	0.0035706	-0.0009766
7	-27.0665145	0.0034 80	-0.0011292
8	-28.193-853	0.0032654	-0.0012817
9	-29.2613511	0.0031128	-0.0014343
10	-30.2451959	0.0029602	-0.0015869
11	-30.8581848	0.0028381	-0.0017090
12	-31.376-858	0.0026855	-0.0018616
13	-31.9055381	0.0025330	-0.0020142
14	-32.4477186	0.0023804	-0.0021667
15	-32.9674416	0.0022278	-0.0023193
16	-33.6517544	0.0020752	-0.0024719
17	-34.2721308	0.0019226	-0.0026245
18	-34.6812849	0.0018005	-0.0027466
19	-34.8774829	0.0016479	-0.0028992
20	-35.0739961	0.0014954	-0.0030518

SNUMB=3389T
07-22,Pass#2

* * * * ANTENNA LOBE SCANNER * * * *

THE MAIN LOBE GAIN IS -0.0423946

LOCATION AND RELATIVE GAIN OF HIGHEST 20 SIDE LOBES

RANK	REL. GAIN (DB)	ANGLE (DEG)
MAIN	0.0	-0.0053402
1	-0.9100628	0.00 1858
2	-8.3654737	-0.01 8975
3	-13.3220763	-0.00 5542
4	-13.3234386	-0.00 1575
5	-14.2142100	0.00 3994
6	-14.3959265	0.00 9722
7	-15.1909032	0.02 7427
8	-17.7445340	-0.00 0049
9	-17.8222694	-0.00 7068
10	-18.8255205	0.00 5520
11	-19.0196204	0.00 8501
12	-20.5583549	-0.00 8523
13	-20.7289724	-0.00 8594
14	-21.5869064	-0.01 6838
15	-21.6405691	0.00 6975
16	-21.8811207	-0.02 1111
17	-21.9078288	0.00 7046
18	-22.7386117	-0.00 6997
19	-23.0051654	-0.00 0120
20	-23.6300283	0.00 5449

MAIN LOBE NULL AND FIRST 20 SIDE-LOBES TO RIGHT OF (ABOVE) MAIN LOBE

RANK	REL. GAIN (DB)	TRUE ANGLE (DEG)	REL. ANGLE (DEG)
MAIN LOBE	** NULL **	-0.0052185	
1	-13.3234386	-0.0051 75	0.0001831
2	-17.7445340	-0.0050 49	0.0003357
3	-20.5583549	-0.0048 23	0.0004883
4	-22.7385117	-0.0046 97	0.0006409
5	-24.6250430	-0.0045 71	0.0007935
6	-26.2261056	-0.0044 50	0.0009155
7	-27.1387397	-0.0042 25	0.0010681
8	-28.0633073	-0.0041 99	0.0012207
9	-29.1221846	-0.0039 73	0.0013733
10	-30.2495098	-0.0038 47	0.0015259
11	-30.7401524	-0.0036 26	0.0016479
12	-31.2700205	-0.0035 00	0.0018005
13	-31.9153004	-0.0033 75	0.0019531
14	-32.7259313	-0.0032 49	0.0021057
15	-33.2693048	-0.0031 28	0.0022278
16	-33.5590234	-0.0029 02	0.0023804
17	-33.7164583	-0.0028 76	0.0025330
18	-34.4144454	-0.0026550	0.0026855
19	-35.0641847	-0.0025 30	0.0028076
20	-35.1356258	-0.0023 04	0.0029602

MAIN LOBE NULL AND FIRST 20 SIDE-LOBES TO LEFT OF (BELOW) MAIN LOBE

RANK	REL. GAIN (DB)	TRUE ANGLE (DEG)	REL. ANGLE (DEG)
MAIN LOBE	** NULL **	-0.0054932	
1	-13.3220763	-0.0055 42	-0.0002136
2	-17.8222694	-0.0057 68	-0.0003662
3	-20.7269724	-0.0058 94	-0.0005188
4	-23.0081654	-0.0060 20	-0.0006714
5	-25.0212088	-0.0061 46	-0.0008240
6	-26.4545121	-0.0062 66	-0.0009460
7	-27.4825482	-0.0064 92	-0.0010986
8	-28.5638571	-0.0065 18	-0.0012512
9	-29.6612396	-0.0067 44	-0.0014038
10	-30.8257065	-0.0068665	-0.0015259
11	-31.3224983	-0.0070 90	-0.0016785
12	-31.8994355	-0.0071 16	-0.0018311
13	-32.6443648	-0.0073 42	-0.0019836
14	-33.5252249	-0.0074768	-0.0021362
15	-33.9523282	-0.0075 89	-0.0022583
16	-34.2432618	-0.0077 15	-0.0024109
17	-35.0100050	-0.0079 41	-0.0025635
18	-35.5782480	-0.0080566	-0.0027161
19	-36.0846286	-0.0081787	-0.0028381
20	-36.2213068	-0.0083313	-0.0029907

SNUMB=3389T
07-22,Pass#3

• • • • ANTENNA LOBE SCANNER • • • •

THE MAIN LOBE GAIN IS 20.8813639

LOCATION AND RELATIVE GAIN OF HIGHEST 20 SIDE LOBES

RANK	REL. GAIN (DB)	ANGLE (DEG)
MAIN	0.0	0.
1	-4.0771418	-0.01-2822
2	-4.0771418	0.01-2822
3	-13.436-686	-0.00 2136
4	-13.436-686	0.00 2136
5	-17.5237599	-0.01-0686
6	-17.5237703	0.01-0686
7	-17.5371184	-0.01-4958
8	-17.5371184	0.01-4958
9	-18.286-709	-0.00 3662
10	-18.286-709	0.00 3662
11	-20.8976326	-0.00 4883
12	-20.8976326	0.00 4883
13	-21.9965057	-0.01 9465
14	-21.9965062	0.01 9465
15	-22.40-3484	-0.01-6484
16	-22.40-3484	0.01-6484
17	-22.967-2651	-0.00 6409
18	-22.967-2651	0.00 6409
19	-24.5669446	-0.01 7939
20	-24.5669451	0.01 7939

MAIN LOBE NULL AND FIRST 20 SIDE-LOBES TO RIGHT OF (ABOVE) MAIN LOBE

RANK	REL. GAIN (DB)	TRUE ANGLE (DEG)	REL. ANGLE (DEG)
MAIN LOBE	** NULL **	0.0001526	
1	-13.436-686	0.0002 36	0.0002136
2	-18.286-709	0.0003662	0.0003662
3	-20.8976326	0.0004883	0.0004883
4	-22.9672651	0.0006-09	0.0006409
5	-24.9295596	0.0007935	0.0007935
6	-26.3970780	0.0009155	0.0009155
7	-27.3809123	0.0010681	0.0010681
8	-28.5861902	0.0012207	0.0012207
9	-29.7519603	0.0013-28	0.0013428
10	-30.2682948	0.0014954	0.0014954
11	-31.0963516	0.0016-79	0.0016479
12	-32.1684532	0.0017700	0.0017700
13	-32.4039388	0.0019226	0.0019226
14	-32.9899573	0.0020752	0.0020752
15	-33.9299765	0.0022278	0.0022278
16	-34.0873079	0.0023499	0.0023499
17	-34.4947338	0.0025 24	0.0025024
18	-35.2692313	0.0026550	0.0026550
19	-35.4659462	0.0027771	0.0027771
20	-35.7294650	0.0029297	0.0029297

MAIN LOBE NULL AND FIRST 20 SIDE-LOBES TO LEFT OF (BELOW) MAIN LOBE

RANK	REL. GAIN (DB)	TRUE ANGLE (DEG)	REL. ANGLE (DEG)
MAIN LOBE	** NULL **	-0.0001526	
1	-13.436-686	-0.0002 136	-0.0002136
2	-18.286-709	-0.0003662	-0.0003662
3	-20.8976326	-0.0004883	-0.0004883
4	-22.9672651	-0.0006-09	-0.0006409
5	-24.9295596	-0.0007935	-0.0007935
6	-26.3970780	-0.0009155	-0.0009155
7	-27.3809123	-0.0010681	-0.0010681
8	-28.5861902	-0.0012207	-0.0012207
9	-29.7519603	-0.0013-28	-0.0013428
10	-30.2682948	-0.0014954	-0.0014954
11	-31.0963516	-0.0016-79	-0.0016479
12	-32.1684532	-0.0017700	-0.0017700
13	-32.4039388	-0.0019226	-0.0019226
14	-32.9899573	-0.0020752	-0.0020752
15	-33.9299765	-0.0022278	-0.0022278
16	-34.0873079	-0.0023499	-0.0023499
17	-34.4947338	-0.0025 24	-0.0025024
18	-35.2692313	-0.0026550	-0.0026550
19	-35.4659462	-0.0027771	-0.0027771
20	-35.7294645	-0.0029297	-0.0029297

SNUMB=3389T
07-22, Pass#4

* * * * ANTENNA LOBE SCANNER * * * *

THE MAIN LOBE GAIN IS 20.1634985

LOCATION AND RELATIVE GAIN OF HIGHEST 20 SIDE LOBES

RANK	REL. GAIN (DB)	ANGLE (DEG)
MAIN	0.0	0.0060421
1	-0.3970051	-0.0000261
2	-9.1534715	0.0020806
3	-12.7116203	-0.0020947
4	-13.0638719	0.0056289
5	-13.1806879	0.0002256
6	-13.9306396	-0.0002397
7	-14.0388944	-0.0008125
8	-17.6648612	0.0006763
9	-17.7982745	0.0003782
10	-18.2460203	-0.0006904
11	-18.6475195	-0.0003618
12	-20.9487314	0.0005542
13	-21.0313020	-0.0005378
14	-21.2195835	0.0005308
15	-21.3192227	-0.0005144
16	-22.5554751	0.0018975
17	-22.6758900	0.0004016
18	-22.8855753	0.0022942
19	-23.0075420	0.0006528
20	-23.5661778	-0.0003853

MAIN LOBE NULL AND FIRST 20 SIDE-LOBES TO RIGHT OF (ABOVE) MAIN LOBE

RANK	REL. GAIN (DB)	TRUE ANGLE (DEG)	REL. ANGLE (DEG)
MAIN LOBE	** NULL **	0.0061646	
1	-13.1806879	0.0062456	0.0000831
2	-17.7982745	0.0063782	0.0002157
3	-21.2195835	0.0065508	0.0003883
4	-23.0095620	0.0066528	0.0004904
5	-24.8426280	0.0068254	0.0006629
6	-26.5348640	0.0069775	0.0008150
7	-27.4832940	0.0070601	0.0008976
8	-28.8833518	0.0072027	0.0010402
9	-29.6853976	0.0073047	0.0011423
10	-30.5147181	0.0074173	0.0012548
11	-31.6889172	0.0076094	0.0014469
12	-32.0253940	0.0077420	0.0015795
13	-33.0026584	0.0079046	0.0017421
14	-33.0721493	0.0080566	0.0020142
15	-33.8197570	0.0082192	0.0021667
16	-34.6763042	0.0083618	0.0023193
17	-34.9126406	0.0084839	0.0024414
18	-35.5367770	0.0086365	0.0025940
19	-36.0362091	0.0087585	0.0027161
20	-36.2629919	0.0089111	0.0028687

MAIN LOBE NULL AND FIRST 20 SIDE-LOBES TO LEFT OF (BELOW) MAIN LOBE

RANK	REL. GAIN (DB)	TRUE ANGLE (DEG)	REL. ANGLE (DEG)
MAIN LOBE	** NULL **	0.0058899	
1	-13.0638719	0.0058189	-0.0002136
2	-17.6648612	0.0056763	-0.0003662
3	-20.9487314	0.0055542	-0.0004883
4	-22.6758900	0.0054016	-0.0006409
5	-24.5160203	0.0052490	-0.0007935
6	-26.0109596	0.0051270	-0.0009155
7	-26.9688044	0.0049744	-0.0010681
8	-28.3730521	0.0048218	-0.0012207
9	-28.9845762	0.0046997	-0.0013428
10	-29.8090572	0.0045471	-0.0014954
11	-30.7984829	0.0044250	-0.0016174
12	-31.1063862	0.0042725	-0.0017700
13	-31.9080706	0.0041199	-0.0019226
14	-32.8002052	0.0039978	-0.0020447
15	-32.9480376	0.0038452	-0.0021973
16	-33.7375655	0.0037231	-0.0023193
17	-33.7749152	0.0035706	-0.0024719
18	-34.4109256	0.0034180	-0.0026245
19	-34.7033286	0.0032959	-0.0027466
20	-34.9442163	0.0031433	-0.0028992

SNUMB=3389T
07-22,Pass#5

* * * * ANTENNA LOBE SCANNER * * * *

THE MAIN LOBE GAIN IS 30.2567911

LOCATION AND RELATIVE GAIN OF HIGHEST 20 SIDE LOBES

RANK	REL. GAIN (DB)	ANGLE (DEG)
MAIN	0.0	-0.0063784
1	-0.1457853	0.0073547
2	-9.6778383	-0.02 0806
3	-11.3466969	0.02 0571
4	-13.0719099	-0.00[illegible]1646
5	-13.1510777	-0.00[illegible]5613
6	-13.5322037	0.0075378
7	-13.5793048	0.00[illegible]1411
8	-17.6810387	0.00[illegible]190
9	-18.0639241	-0.00[illegible]120
10	-18.0991302	0.0076904
11	-18.1277824	-0.00[illegible]7139
12	-20.5484202	-0.0058899
13	-20.7545096	-0.00[illegible]8358
14	-20.8067522	0.00 8665
15	-21.36-5706	0.00 8125
16	-22.5552982	-0.01[illegible]8669
17	-22.9893527	-0.00[illegible]7373
18	-23.1532242	0.00[illegible]7444
19	-23.2406265	-0.00[illegible]8685
20	-23.26-6387	0.0079651

MAIN LOBE NULL AND FIRST 20 SIDE-LOBES TO RIGHT OF (ABOVE) MAIN LOBE

RANK	REL. GAIN (DB)	TRUE ANGLE (DEG)	REL. ANGLE (DEG)
MAIN LOBE	** NULL **	-0.0062256	
1	-13.0719099	-0.0061[illegible]46	0.0002136
2	-18.0639210	-0.0060 20	0.0003662
3	-20.5184202	-0.0058[illegible]99	0.0004883
4	-22.9893827	-0.0057[illegible]73	0.0006409
5	-24.3704286	-0.0056[illegible]52	0.0007629
6	-26.0870004	-0.0054[illegible]26	0.0009155
7	-26.9924340	-0.0053[illegible]06	0.0010376
8	-28.2995371	-0.0051[illegible]80	0.0011902
9	-28.9260540	-0.0050[illegible]59	0.0013123
10	-30.0457816	-0.0049 33	0.0014648
11	-30.4815959	-0.0047[illegible]13	0.0015869
12	-31.4425478	-0.0046[illegible]87	0.0017395
13	-31.7360935	-0.0045[illegible]66	0.0018616
14	-32.6272459	-0.0043[illegible]40	0.0020142
15	-32.8040972	-0.0042[illegible]19	0.0021362
16	-33.6272922	-0.0040[illegible]94	0.0022888
17	-33.7086210	-0.0039[illegible]73	0.0024109
18	-34.4898491	-0.0038[illegible]47	0.0025635
19	-34.4752536	-0.0036[illegible]26	0.0026855
20	-35.2643590	-0.0035400	0.0028381

MAIN LOBE NULL AND FIRST 20 SIDE-LOBES TO LEFT OF (BELOW) MAIN LOBE

RANK	REL. GAIN (DB)	TRUE ANGLE (DEG)	REL. ANGLE (DEG)
MAIN LOBE	** NULL **	-0.0065002	
1	-13.1510777	-0.0065[illegible]13	-0.0001831
2	-18.1207824	-0.0067[illegible]39	-0.0003357
3	-20.7545094	-0.0068[illegible]59	-0.0004578
4	-23.2408285	-0.0069[illegible]85	-0.0006104
5	-24.7934713	-0.0071[illegible]06	-0.0007324
6	-26.4536657	-0.0072[illegible]32	-0.0008850
7	-27.5298929	-0.0073[illegible]53	-0.0010071
8	-28.8396142	-0.0075[illegible]78	-0.0011597
9	-29.6377177	-0.0076[illegible]99	-0.0012817
10	-30.7009635	-0.0078[illegible]25	-0.0014343
11	-31.3118243	-0.0079[illegible]46	-0.0015564
12	-32.2614455	-0.0080[illegible]72	-0.0017090
13	-32.7325158	-0.0082 92	-0.0018311
14	-33.5717311	-0.0083[illegible]18	-0.0019836
15	-33.9354949	-0.0084[illegible]39	-0.0021057
16	-34.7201190	-0.0086[illegible]65	-0.0022583
17	-34.9925299	-0.0087[illegible]85	-0.0023804
18	-35.7386830	-0.0089[illegible]11	-0.0025330
19	-35.9405408	-0.0090[illegible]32	-0.0026550
20	-36.6177163	-0.0091[illegible]58	-0.0028076

SNUMB=3389T
07-22,Pass#6

* * * * ANTENNA LOBE SCANNER * * * *

THE MAIN LOBE GAIN IS 71.2974668

LOCATION AND RELATIVE GAIN OF HIGHEST 20 SIDE LOBES

RANK	REL. GAIN (DB)	ANGLE (DEG)
MAIN	0.0	0.000624
1	-3.5930748	-0.0017258
2	-4.7236242	0.0013433
3	-13.465934[illegible]	0.00 0071
4	-13.6019511	0.00 6409
5	-16.7247262	-0.0015122
6	-16.8481421	-0.0029089
7	-17.7184024	0.0011602
8	-17.8118229	0.00 4883
9	-17.8797989	0.00 1597
10	-18.0223069	0.0015569
11	-21.0616384	0.00 2817
12	-21.1984563	0.00 3662
13	-21.3267379	-0.0013901
14	-22.0312123	-0.0030310
15	-22.5339313	0.0010381
16	-22.9519306	0.00 2136
17	-22.9861994	0.0016790
18	-23.0683169	0.00 4343
19	-24.0321965	-0.0012375
20	-24.5228972	-0.0031836

MAIN LOBE NULL AND FIRST 20 SIDE-LOBES TO RIGHT OF (ABOVE) MAIN LOBE

RANK	REL. GAIN (DB)	TRUE ANGLE (DEG)	REL. ANGLE (DEG)
MAIN LOBE	** NULL **	0.0009460	
1	-13.4653348	0.0010 71	0.0001831
2	-17.8797989	0.0011897	0.0003357
3	-21.0616384	0.0012 17	0.0004578
4	-23.0683169	0.0014943	0.0006104
5	-24.8735061	0.0015564	0.0007324
6	-26.3520017	0.0017 90	0.0008850
7	-27.4689746	0.0018311	0.0010071
8	-28.8047645	0.0019836	0.0011597
9	-29.4710913	0.0021 57	0.0012817
10	-30.8213544	0.0022278	0.0014038
11	-31.0994225	0.0023 04	0.0015564
12	-32.0667491	0.0025 24	0.0016785
13	-32.5552506	0.0026550	0.0018311
14	-33.0991125	0.0027771	0.0019531
15	-33.7799625	0.0029297	0.0021057
16	-34.1193690	0.0030518	0.0022278
17	-35.0198164	0.0032 43	0.0023804
18	-35.0237913	0.0033264	0.0025024
19	-35.7956085	0.0034 85	0.0026245
20	-35.8615632	0.0036 11	0.0027771

MAIN LOBE NULL AND FIRST 20 SIDE-LOBES TO LEFT OF (BELOW) MAIN LOBE

RANK	REL. GAIN (DB)	TRUE ANGLE (DEG)	REL. ANGLE (DEG)
MAIN LOBE	** NULL **	0.0006714	
1	-13.6019511	0.0006 09	-0.0001831
2	-17.8118229	0.0004 83	-0.0003357
3	-21.1984563	0.0003 62	-0.0004578
4	-22.9519806	0.0002 36	-0.0006104
5	-24.9763432	0.0000 16	-0.0007324
6	-26.1937399	-0.0000910	-0.0008850
7	-27.4775105	-0.0001831	-0.0010071
8	-28.6365709	-0.0003357	-0.0011597
9	-29.3620181	-0.0004578	-0.0012817
10	-30.5860200	-0.0006104	-0.0014343
11	-30.9345061	-0.0007324	-0.0015564
12	-32.0803679	-0.0008545	-0.0016785
13	-32.2593139	-0.0010 71	-0.0018311
14	-33.1491699	-0.0011292	-0.0019531
15	-33.5447454	-0.0012817	-0.0021057
16	-33.9922433	-0.0014 38	-0.0022278
17	-34.6511087	-0.0015564	-0.0023804
18	-34.8183942	-0.0016785	-0.0025024
19	-35.7722073	-0.0018311	-0.0026550
20	-35.6241732	-0.0019531	-0.0027771

SNUMB=2730T
07-22,Pass#1

* * * * ANTENNA LOBE SCANNER * * * *

THE MAIN LOBE AXIS IS [illegible]

RANK	REL. DATA (DB)	TRUE ANGLE (DEG)	REL. ANGLE (DEG)
MAIN LOBE	** WILL **	[illegible]	
1	-7.757 459	[illegible]	[illegible]
2	-2.4	[illegible]	[illegible]
3	+17.9	[illegible]	[illegible]
4	+17.1	[illegible]	[illegible]
5	+21.3	[illegible]	[illegible]
6	+25.	[illegible]	[illegible]
7	+24.	[illegible]	[illegible]
8	+27.	[illegible]	[illegible]
9	+28.	[illegible]	[illegible]
10	+29.	[illegible]	[illegible]
11	+29.	[illegible]	[illegible]
12	+3.	[illegible]	[illegible]
13	+31.	[illegible]	[illegible]
14	+31.	[illegible]	[illegible]
15	+31.	[illegible]	[illegible]
16	+33.	[illegible]	[illegible]
17	+33.	[illegible]	[illegible]
18	+33.	[illegible]	[illegible]
19	+33.	[illegible]	[illegible]
20	+35.	[illegible]	-0.0124512

MAIN LOBE WILL AND FIRST 20 SIDE-LOBES TO RIGHT OF (ABOVE) MAIN LOBE

RANK	REL. DATA (DB)	TRUE ANGLE (DEG)	REL. ANGLE (DEG)
MAIN LOBE	** WILL **	[illegible]	
1	-26.1394177	[illegible] 93711	0.0008545
2	-7.8782877	[illegible] 61135	0.0015569
3	-33.8155674	[illegible] 58307	0.0021493
4	-35.18 4510	[illegible] 77694	0.0 3 513
5	-17.6755947	[illegible] 01787	0.0031821
6	-38.9351559	[illegible] 88121	0.0040945
7	-41.1317167	[illegible] 96436	0.0051271
8	-40.9148598	0.0062839	0.0057373
9	-41.4269501	0.0066963	0.0064977
10	-41.9725443	0.0071947	0.0077801
11	-42.7 6529	[illegible] 23491	0.007 -129
12	-42.4757674	0.0083515	0.0085449
13	-42.6151799	[illegible] 37939	0.0092773
14	-42.1132993	0.0096443	0.0098877
15	-41.6 3244	[illegible] 31567	0.0104201
16	-41.3429770	0.0107471	0.0111315
17	-39.9232922	[illegible] 94795	0.0114629
18	-38.3385399	0.0117119	0.0124573
19	-36.0539938	[illegible] 79443	0.0134277
20	-31.2782688	0.0165547	0.0174 [illegible]

MAIN LOBE WILL AND FIRST 20 SIDE-LOBES TO LEFT OF (BELOW) MAIN LOBE

RANK	REL. DATA (DB)	TRUE ANGLE (DEG)	REL. ANGLE (DEG)
MAIN LOBE	** WILL **	0.0041945	
1	-17.5862148	[illegible] 42725	-0.0002441
2	-27.1647 78	0.0034180	-0.0011996
3	-31.5112793	[illegible] 25178	-0.0017090
4	-33.8499696	0.0021752	-0.0024414
5	-35.5994736	[illegible] 13428	-0.0031738
6	-36.4902348	0.0056104	-0.0039063
7	-37.7883929	[illegible]	-0.0045166
8	-38.5539885	-0.0007324	-0.0052490
9	-39.3478676	[illegible] 13428	-0.0059594
10	-39.6999459	-0.0021752	-0.0066715
11	-39.7714596	[illegible] 28076	-0.0073242
12	-39.9554718	-0.0074180	-0.0079346
13	-39.5719719	[illegible] 41504	-0.0085670
14	-39.3799324	-0.0 48828	-0.0091994
15	-38.7448692	[illegible] 54932	-0.0100098
16	-37.6933323	-0.0 59256	-0.0107422
17	-36.7437935	[illegible] 69580	-0.0114746
18	-35.3432250	-0.0075684	-0.0122850
19	-33.0169830	[illegible] 83019	-0.0128174
20	-29.7449036	-0.0090332	-0.0135498

SNUMB=2730T
07-22,Pass#2

• • • • ANTENNA CORE SCANNER • • • •

THE MAIN LOBE IS [illegible]

BEAM	REL. GAIN (DB)	TRUE ANGLE (DEG)	REL. ANGLE (DEG)
MAIN	[illegible]	[illegible]	
1	-0.3255916	[illegible]	
2	-0.1441977	[illegible]	
3	-17.6436106	[illegible]	
4	-18.0397149	[illegible]	
5	-22.1643726	[illegible]	
6	-24.3922264	[illegible]	
7	-25.3394871	[illegible]	
8	-26.5427754	[illegible]	
9	-28.5234160	[illegible]	
10	-29.6117393	[illegible]	
11	-29.7447739	[illegible]	
12	-31.0171259	[illegible]	
13	-31.7279367	[illegible]	
14	-32.4319425	[illegible]	
15	-32.8184497	[illegible]	
16	-33.1977755	[illegible]	
17	-33.6741791	[illegible]	
18	-34.4533503	[illegible]	
19	-34.8237899	[illegible]	
20	-35.5359795	[illegible]	

MAIN LOBE NULL AND FIRST 20 SIDE-LOBES TO RIGHT OF (ABOVE) MAIN LOBE

BEAM	REL. GAIN (DB)	TRUE ANGLE (DEG)	REL. ANGLE (DEG)
MAIN LOBE	** NULL **	-0.[illegible]	
1	-26.3364230	[illegible]	0.0109766
2	-31.2777563	[illegible]	0.0213311
3	-33.6741991	[illegible]	0.0328635
4	-35.6357316	[illegible]	0.0432759
5	-37.4396617	[illegible]	0.0544283
6	-38.2319975	[illegible]	0.0643878
7	-39.7331381	[illegible]	0.0758152
8	-39.2777525	[illegible]	0.0863477
9	-39.6999439	[illegible]	0.0973801
10	-39.6931725	[illegible]	0.1079346
11	-39.1173962	[illegible]	0.1186671
12	-38.6224090	[illegible]	0.1293994
13	-37.9831491	[illegible]	0.1401318
14	-37.1239639	[illegible]	0.1509363
15	-36.4237895	[illegible]	0.1617168
16	-35.2697755	[illegible]	0.1724512
17	-29.7440939	[illegible]	0.2139995
18	-22.3543 28	[illegible]	0.2514 351
19	-1.6269916	[illegible]	0.3145284
20	-25.5457754	[illegible]	0.3153519

MAIN LOBE NULL AND FIRST 20 SIDE-LOBES TO LEFT OF (BELOW) MAIN LOBE

BEAM	REL. GAIN (DB)	TRUE ANGLE (DEG)	REL. ANGLE (DEG)
MAIN LOBE	** NULL **	-0.[illegible]	
1	-18.0397149	[illegible]	-0.0003662
2	-28.5234160	[illegible]	-0.0017207
3	-32.6044497	[illegible]	-0.0 14531
4	-35.5387755	[illegible]	-0.0025855
5	-37.7017999	[illegible]	-0.0036400
6	-39.0355771	[illegible]	-0.0047725
7	-40.5483329	[illegible]	-0.0058049
8	-41.2543957	[illegible]	-0.0067373
9	-42.0355105	[illegible]	-0.0086697
10	-42.6729792	[illegible]	-0.0097242
11	-42.6199236	[illegible]	-0.0086566
12	-42.6321793	[illegible]	-0.0086891
13	-42.5260714	[illegible]	-0.0096215
14	-42.2517796	[illegible]	-0.0105761
15	-41.4479656	[illegible]	-0.0115084
16	-40.1752172	[illegible]	-0.0124408
17	-35.4483217	[illegible]	-0.0129732
18	-34.6533632	[illegible]	-0.0134277
19	-24.8722523	[illegible]	-0.0142822
20	-8.3489970	-0.0198979	-0.0149264

SNUMB=2730T
07-22, Pass#3

• • • • ANTENNA LOBE SCANNER • • • •

[illegible]

LOCATION & RELATIVE DATA OF HIGHEST SIDE LOBE

RANK	REL. DATA (DEG)	REL. AMPLITUDE (DEG)
MAIN	-4.[illegible]	-0.0142522
1	-4.[illegible]	0.0142522
2	-21.2134455	-0.0140381
3	-21.2134455	0.0140381
4	-25.6662231	0.0112207
5	-25.6662231	-0.0112207
6	-32.7337777	-0.0[illegible]
7	-32.7337777	0.0[illegible]
8	-32.9[illegible]	-0.0[illegible]
9	-32.9[illegible]	0.0[illegible]
10	-33.3932352	-0.0[illegible]
11	-33.3932352	0.0[illegible]
12	-33.7296936	-0.0027697
13	-33.7296936	0.0027697
14	-35.9822451	-0.0122070
15	-35.9822451	0.0122070
16	-37.6419535	-0.0[illegible]
17	-37.6419535	0.0[illegible]
18	-38.0847845	-0.0113525
19	-38.0847845	0.0113525
20	-38.0847845	0.0113525

MAIN LOBE NULL AND FIRST 20 SIDE-LOBES TO RIGHT OF (ABOVE) MAIN LOBE

RANK	REL. DATA (DEG)	TRUE AMPLITUDE (DEG)	REL. AMPLITUDE (DEG)
MAIN LOBE	** NULL **	0.000[illegible]	
1	-20.5362431	[illegible]	0.0112207
2	-32.9[illegible]	[illegible]	0.002[illegible]
3	-35.7296936	[illegible]	0.0027697
4	-37.6419535	[illegible]	0.0037842
5	-39.[illegible]	[illegible]	0.0046387
6	-40.[illegible]	[illegible]	0.0054932
7	-40.7945892	0.0063477	0.0063477
8	-41.0789352	0.0072021	0.0072021
9	-41.[illegible]	0.0079346	0.0079346
10	-42.[illegible]	0.0087891	0.0087891
11	-43.[illegible]	0.0096436	0.0096436
12	-39.4749316	[illegible]	0.0104980
13	-38.[illegible]	0.0113525	0.0113525
14	-35.8822451	0.0122070	0.0122070
15	-32.[illegible]	0.0130615	0.0130615
16	-21.2134455	0.0140381	0.0140381
17	-4.[illegible]	0.0142522	0.0142522
18	-33.3932352	0.0155029	0.0155029
19	-38.4747491	0.0163574	0.0163574
20	-41.9383226	0.0172119	0.0172119

MAIN LOBE NULL AND FIRST 20 SIDE-LOBES TO LEFT OF (BELOW) MAIN LOBE

RANK	REL. DATA (DEG)	TRUE AMPLITUDE (DEG)	REL. AMPLITUDE (DEG)
MAIN LOBE	** NULL **	-0.000[illegible]	
1	-20.5362236	-0.0112207	-0.0112207
2	-32.99[illegible]	-0.0[illegible]	-0.00[illegible]
3	-35.7296936	-0.0[illegible]	-0.0027697
4	-37.6419535	-0.0[illegible]	-0.0037842
5	-39.[illegible]	-0.0[illegible]	-0.0046387
6	-40.[illegible]	-0.0[illegible]	-0.0054932
7	-40.7945892	-0.0[illegible]	-0.0063477
8	-41.0789352	-0.0[illegible]	-0.0072021
9	-41.[illegible]	-0.0[illegible]	-0.0079346
10	-42.[illegible]	-0.0[illegible]	-0.0087891
11	-43.[illegible]	-0.0[illegible]	-0.0096436
12	-39.4749316	-0.0[illegible]	-0.0104980
13	-38.[illegible]	-0.0113525	-0.0113525
14	-35.8822451	-0.0122070	-0.0122070
15	-32.[illegible]	-0.0130615	-0.0130615
16	-21.2134455	-0.0140381	-0.0140381
17	-4.[illegible]	-0.0142522	-0.0142522
18	-33.3932352	-0.0155029	-0.0155029
19	-38.4747476	-0.0163574	-0.0163574
20	-41.9383221	-0.0172119	-0.0172119

SNUMB=2730T
07-22,Pass#4

• • • • ANTENNA LOBE SCANNER • • • •

THE MAIN LOBE GAIN IS 69.191 4[illegible]

LOCATION AND RELATIVE GAIN OF HIGHEST 20 SIDE LOBES

RANK	REL. GAIN (DB)	ANGLE (DEG)
MAIN	0.	-0.00[illegible]963
1	-0.4772911	0.0059514
2	-12.8297132	0.0021416
3	-11.8216515	-0.0021947
4	-22.1698711	-0.0065447
5	-23.3716564	0.0053711
6	-25.9963100	0.0069550
7	-26.1[illegible]89[illegible]	-0.0061328
8	-26.[illegible]23415	0.0041797
9	-27.1726569	-0.0067380
10	-30.1141466	0.0049725
11	-30.7551367	-0.0095215
12	-31.5916644	-0.0059814
13	-32.7156183	0.0079346
14	-32.0134763	-0.0082389
15	-33.2025459	0.0017195
16	-33.4177957	0.0034180
17	-34.5734353	-0.0080249
18	-34.9426146	-0.01[illegible]
19	-34.7907344	0.00[illegible]
20	-35.2793307	0.0089111

MAIN LOBE NULL AND FIRST 20 SIDE-LOBES TO RIGHT OF (ABOVE) MAIN LOBE

RANK	REL. GAIN (DB)	TRUE ANGLE (DEG)	REL. ANGLE (DEG)
MAIN LOBE	** NULL **	-0.0073242	
1	-27.1726569	-0.0069580	0.0013956
2	-31.5916644	-0.0059814	0.002[illegible]752
3	-34.5734353	-0.0050049	0.003[illegible]516
4	-36.0337613	-0.0040283	0.004[illegible]2[illegible]3
5	-37.3519727	-0.0031738	0.0045525
6	-37.5827605	-0.0021973	0.0055594
7	-38.3420620	-0.0013428	0.0067139
8	-38.1477317	-0.0003662	0.0074904
9	-37.6713419	0.0006104	0.0084673
10	-36.6415219	0.0014648	0.0095715
11	-35.4162674	0.0024414	0.0104970
12	-33.4177957	0.0034180	0.0114746
13	-30.1141486	0.0040725	0.0123291
14	-23.3716564	0.0053711	0.0134277
15	-0.4772911	0.0059814	0.014[illegible]3[illegible]1
16	-25.9963100	0.0069550	0.015[illegible]146
17	-32.7156183	0.0079346	0.0159912
18	-35.2793307	0.0089111	0.0165675
19	-37.7255549	0.0093877	0.0173443
20	-39.2811359	0.0107422	0.0187[illegible]

MAIN LOBE NULL AND FIRST 20 SIDE-LOBES TO LEFT OF (BELOW) MAIN LOBE

RANK	REL. GAIN (DB)	TRUE ANGLE (DEG)	REL. ANGLE (DEG)
MAIN LOBE	** NULL **	-0.0083[illegible]	
1	-22.1354711	-0.0065449	-0.0004683
2	-30.6951369	-0.0095215	-0.0014648
3	-34.9425146	-0.0104980	-0.0024414
4	-37.8352353	-0.0114746	-0.0034180
5	-39.7412370	-0.0124512	-0.0043945
6	-41.1713119	-0.0133357	-0.0052490
7	-42.1395646	-0.0142822	-0.0062256
8	-43.2103673	-0.0151367	-0.0077[illegible]01
9	-43.2485232	-0.0161133	-0.00[illegible]566
10	-43.7723133	-0.0170898	-0.00[illegible]332
11	-43.4565619	-0.0180664	-0.0100098
12	-42.9139639	-0.0189207	-0.0109643
13	-41.4479532	-0.0198975	-0.0115466
14	-38.5743534	-0.0208740	-0.0129174
15	-11.6235316	-0.0220947	-0.014[illegible]381
16	-12.3034793	-0.0223379	-0.0142822
17	-45.0174120	-0.0234375	-0.0153809
18	-51.9099217	-0.0244141	-0.0163574
19	-57.5894951	-0.0253906	-0.0173340
20	-63.9585592	-0.0262451	-0.0181885

• • • • ANTENNA LOBE SCANNER • • • •

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THE MAIN LOBE GAIN IS 71.231 DB

LOCATION AND RELATIVE GAIN OF HIGHEST 20 SIDE LOBES

RANK	REL. GAIN (DB)	TRUE ANGLE (DEG)	REL. ANGLE (DEG)
MAIN LOBE	0.0	-0.0083477	
1	-7.5134146	-0.0073242	
2	-12.1271935	-0.0229199	
3	-14.1572962	-0.0241132	
4	-22.3931937	-0.0083594	
5	-23.8396463	-0.0097137	
6	-24.1942419	-0.0134700	
7	-24.9233721	-0.0087135	
8	-31.0996399	-0.0086670	
9	-30.6477465	-0.0073125	
10	-31.4 96375	-0.0069387	
11	-31.9476743	-0.0054732	
12	-35.1392743	-0.0084140	
13	-35.4132609	-0.0080945	
14	-35.5845864	-0.0077650	
15	-35.7026949	-0.0087111	
16	-35.7925267	-0.0099377	
17	-37.1746646	-0.0083193	
18	-37.37 .086	-0.0090192	
19	-37.39*1565	-0.0032957	
20	-38.3492306	-0.0012207	

MAIN LOBE NULL AND FIRST 20 SIDE-LOBES TO RIGHT OF (ABOVE) MAIN LOBE

RANK	REL. GAIN (DB)	TRUE ANGLE (DEG)	REL. ANGLE (DEG)
MAIN LOBE	** NULL **	-0.0078125	
1	-22.3931637	-0.0058594	0.0004883
2	-31.4769375	-0.0046387	0.0017090
3	-35.1392743	-0.0034180	0.0029297
4	-37.1774646	-0.0023193	0.0041283
5	-38.3452306	-0.0012207	0.0051270
6	-39.9274443	-0.0001221	0.0062256
7	-39.0027494	0.0009766	0.0073242
8	-38.5727114	0.0020752	0.0084229
9	-37.3931566	0.0032959	0.0096436
10	-35.4130609	0.0043945	0.0107422
11	-31.9476743	0.0054932	0.0118408
12	-23.8355433	0.0067139	0.0130615
13	-0.5134146	0.0073242	0.0136719
14	-30.5846899	0.0088870	0.0151146
15	-35.7925267	0.0098877	0.0161354
16	-39.0274224	0.0109863	0.0172340
17	-41.0941172	0.0120850	0.0183326
18	-42.6[illegible]5892	0.0131836	0.0194313
19	-43.6[illegible]7653	0.0144043	0.0206520
20	-44.0869984	0.0155029	0.0217506

MAIN LOBE NULL AND FIRST 20 SIDE-LOBES TO LEFT OF (BELOW) MAIN LOBE

RANK	REL. GAIN (DB)	TRUE ANGLE (DEG)	REL. ANGLE (DEG)
MAIN LOBE	** NULL **	-0.0073242	
1	-30.6477465	-0.0078125	-0.0004883
2	-35.7025849	-0.0089111	-0.0015869
3	-38.5614672	-0.0101318	-0.0027832
4	-40.8124320	-0.0111328	-0.0037842
5	-41.9594906	-0.0123291	-0.0049814
6	-42.8022618	-0.0134277	-0.0060801
7	-43.2013716	-0.0145264	-0.0071787
8	-43.0944392	-0.0158250	-0.0084773
9	-42.2693302	-0.0168457	-0.0094980
10	-41.2774323	-0.0179443	-0.0105967
11	-35.5349864	-0.0191650	-0.0118174
12	-12.1271535	-0.0200195	-0.0126719
13	-39.3631672	-0.0211182	-0.0137705
14	-47.7795745	-0.0222168	-0.0148691
15	-53.5427175	-0.0234375	-0.0160898
16	-59.5427250	-0.0245361	-0.0171885
17	-65.5[illegible]734	-0.0256348	-0.0182871
18	-74.6[illegible]294	-0.0266113	-0.0192637
19	-78.712[illegible]42	-0.0280762	-0.0207285
20	-70.0078170	-0.0290527	-0.0217051

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* * * * ANTENNA LOBE SCANNER * * * *

THE MAIN LOBE WAS AT [illegible]

LOCATION AND RELATIVE GAIN OF HIGHEST 20 SIDE LOBES

RANK	REL. GAIN (DB)	ANGLE (DEG)
MAIN	0.0	[illegible]
1	-0.9281025	-0.0126493
2	-9.6441837	0.0144268
3	-25.1115858	0.0215869
4	-28.4973002	-0.0141850
5	-29.6313457	-0.0397749
6	-29.7761145	-0.0014049
7	-31.[illegible]1212	[illegible]
8	-32.[illegible]6501	0.0136019
9	-33.8716057	0.0228297
10	-34.2506365	-0.0242451
11	-34.6574206	-0.0107422
12	-34.8149157	-0.0119831
13	-35.1128554	-0.0142372
14	-36.6785373	0.0240729
15	-37.5175836	0.0117143
16	-37.6833332	-0.0031736
17	-37.[illegible]5796	-0.0093994
18	-38.[illegible]7729	0.0279541
19	-39.6802177	0.0054932
20	-39.[illegible]7469	-0.0043945

MAIN LOBE NULL AND FIRST 20 SIDE-LOBES TO RIGHT OF (ABOVE) MAIN LOBE

RANK	REL. GAIN (DB)	TRUE ANGLE (DEG)	REL. ANGLE (DEG)
MAIN LOBE	** NULL **	0.[illegible]7976	
1	-25.1115858	0.0215869	0.0083324
2	-32.7714153	0.0329297	0.0092752
3	-36.6729373	0.0442725	0.0034180
4	-38.6[illegible]3177	0.0554932	0.0146387
5	-39.9[illegible]9141	0.0667137	0.0258594
6	-40.5[illegible]24	0.0779345	0.0370801
7	-41.3153857	0.0892773	0.0484229
8	-39.3[illegible]729	0.1004980	0.0596436
9	-37.3[illegible]836	0.1117188	0.0708643
10	-32.[illegible]3531	0.1230615	0.0822070
11	-9.6441837	0.1342823	0.0934278
12	-31.[illegible]1212	0.1455029	0.1046483
13	-39.[illegible]3470	0.1568456	0.1159911
14	-44.54[illegible]53	0.1680663	0.1272118
15	-47.3[illegible]143	0.1792869	0.1384325
16	-50.6022635	0.1905298	0.1496753
17	-53.[illegible]4490	0.2018064	0.1609520
18	-55.5424957	0.2130271	0.1721727
19	-56.[illegible]9625	0.2241699	0.1833154
20	-61.2565[illegible]40	0.2353906	0.1945361

MAIN LOBE NULL AND FIRST 20 SIDE-LOBES TO LEFT OF (BELOW) MAIN LOBE

RANK	REL. GAIN (DB)	TRUE ANGLE (DEG)	REL. ANGLE (DEG)
MAIN LOBE	** NULL **	-0.[illegible]231	
1	-29.7761145	-0.0014049	-0.0014049
2	-34.8149157	-0.0119831	-0.0023576
3	-37.4[illegible]332	-0.0231736	-0.0094283
4	-39.[illegible]7469	-0.0343943	-0.0206490
5	-39.9144[illegible]26	-0.0457373	-0.0320916
6	-39.94[illegible]272	-0.0569580	-0.0433125
7	-39.2951279	-0.0681787	-0.0545332
8	-37.8383296	-0.0793994	-0.0657539
9	-34.6574206	-0.0907422	-0.0770967
10	-25.4973022	-0.1020630	-0.0884175
11	-2.9241[illegible]28	-0.1[illegible]933	-0.0995478
12	-35.1128554	-0.0142372	-0.0315367
13	-40.6[illegible]2743	-0.0136250	-0.0104795
14	-44.2[illegible]640	-0.0155457	-0.0177002
15	-46.9[illegible]957	-0.0[illegible]664	-0.0198209
16	-49.1[illegible]922	-0.0194092	-0.0220837
17	-50.[illegible]5515	-0.0206299	-0.0214644
18	-52.2[illegible]349	-0.0218506	-0.0227051
19	-53.3027477	-0.0230713	-0.0239258
20	-53.8054329	-0.0242920	-0.0251465

APPENDIX K

INTERACTIVE RADAR SIMULATOR

DESIGN STUDY

K.1 INTRODUCTION

This appendix documents the results of a study and investigation directed toward the design of an Interactive Radar Simulation system. The Interactive Radar Simulation system described herein will significantly improve the efficiency of design engineers in performing radar system evaluations, in testing new concepts, and in predicting the effect of subsystem parameter changes on total system performance. The suggested design includes features that will streamline the process by which the RADC Radar System Simulation Model (RADSIM) computer program is used.

This streamlining consists of eliminating the menial, time-consuming tasks which are associated with the present method for submission of batch or time sharing computer jobs. An example of this is the typing of simulation control and module parameter cards on either a keypunch machine or a time sharing terminal. At the output end of the simulation process, the digestion of output data by the user is improved by the use of a high resolution CRT graphics display. This device will allow the plotting of output data directly from the host computer. In addition, all information required to convert a radar system block diagram into a form suitable for simulation model usage will be stored locally on magnetic tape in a catalog form complete with index and cross references so that it can be used in the same manner as a reference document. The hardware system for implementing these improvements will be referred to as the Dedicated User Interface (DUI). The Interactive Radar Simulator system described herein consists of the Radar System Simulation Model (RADSIM) computer program, the Honeywell 635 host computer (H635) and the Dedicated User Interface (DUI).

K.2 INTERACTIVE RADAR SIMULATOR BACKGROUND AND REQUIREMENTS

In this section the background and shortcomings of the existing RADSIM computer are discussed and the Dedicated User Interface (DUI) is described in functional terms.

K.2.1 Simulation Model Usage

The RADSIM computer program in its present configuration consists of two segments which are executed as separate activities. These segments are referred to as the Simulation Data Initializer and the Simulation Controller/Modules.

The Simulation Data Initializer serves as the interface between the user and the Simulation Controller. This segmentation of the simulation model computer program was necessary since input data in a format convenient to the user must be converted to a form suitable for use by the simulation modules. The user defines the simulation via two types of punch cards: simulation control cards and module parameter data cards. The term punch card is used here in the sense of either a physical punch card or of a card image if the job is submitted through the CARDIN time sharing subsystem of the H635.

The simulation control cards determine what operations are to be performed in the simulation activity. This includes the following: (1) scheduling of modules for execution, (2) data transfer to and from temporary disc files, and (3) modification of parameters for multiple executions of a simulation model configuration.

The module parameter data cards define the parameters of the simulation modules to be executed in the simulation activity. Each module requiring input data has a unique namelist which contains the input parameters. Upon completion of the Data Initialization activity, the Simulation activity is executed.

At the present time the output data of a simulation job is written onto a permanent disc file or magnetic tape, or punched on cards. The user then picks up the output data at the central site of the host computer or uses the time sharing system to dump data stored on permfile to paper tape or to listing paper.

K.2.2 Simulation Model Limitations

In subsection K.2.1 the use of the existing RADSIM computer program was briefly reviewed. In this subsection those aspects of the computer program which restrict or otherwise hinder the use of the simulation model will be discussed. In performing a simulation job there are two phases which consume the majority of the user's time, i.e. the operations of data input and data retrieval. In other words, the major bottleneck is the interface between the user and the host computer. Most of the time spent in performing these tasks is not engineering design time, e.g. the keypunching of control and module parameter cards or alternatively, typing the cards into a time sharing file. In addition to the typing task, the user must constantly refer to tables of module names, reference numbers, parameters, and units of measure during the process of converting a radar system block diagram into a form suitable for input into the RADSIM computer program.

At the present time, the output of a simulation job is written onto a permanent disc file or on magnetic tape, or is punched on cards. This aspect of the process of accomplishing a simulation is a significant factor in job turn around and is probably the most expensive portion when the manhours expended in the manual handling of data are considered.

In order to summarize the limitations described above, the following example of a simulation job is offered:

1. The user defines the block diagram complete with the parameters of a system to be simulated. (Elapsed time = 2.0 Hours, User Time = 2.0)

2. The user converts the block diagram into a deck of cards suitable for input to the data loader activity. (Elapsed Time = 2.0 Hours, User Time = 2.0)

3. The user submits the job to the host computer and the job is executed. (Elapsed Time = 1.0 Hours, User Time = 0.25 Hours)

4. The user retrieves the output data in the form of punch cards or magnetic tape, transports the data to an off line plotter system, and plots the data. (Elapsed Time = 2.0 Hours, User Time = 2.0 Hours)

In the above example the user spent 6.25 hours performing a complete simulation job of which only 2.0 hours were used in performing an engineering design task. Approximately 60% of the design engineer's time was consumed by non-engineering tasks. In the following subsection a system is described from a functional viewpoint which will improve the productivity of the radar design engineer by freeing him from the menial tasks which must be performed in order to use the current RADSIM computer program. In the example presented above, if the data were dumped to paper tape via an ASR 33 teletype, the time required would be even greater since the ASR 33 data transfer rate is only 10 characters per second (cps). Since 10 to 13 characters are required to represent one floating point number this corresponds to one point of data per second or less. A plot of 3000 points would therefore, require almost one hour to punch on paper tape.

K.2.3 Dedicated User Interface

A Dedicated User Interface for the submission of simulation jobs and retrieval of output data should, as a minimum, have the following capabilities:

(1) Storage for all computer program data required by the user for the specifcation of parameters

(2) The capability of producing block diagrams of the simulation job

(3) Storage for the job definition file such that it can be used in the construction of future simulation jobs

(4) A high data rate channel for communication with the host computer. The upper bound on data rate will be determined by characteristics of a voice grade direct dial telephone channel

(5) A high resolution CRT display capable of plotting the output data

(6) A device capable of producing a high quality paper copy of anything presented on the CRT display.

With a system having these capabilities, the procedure of job setup will simply be a matter of the user answering a sequence of questions posed by the DUI. When the job definition is complete, the user will have a paper copy of the

simulation block diagram and a magnetic tape cassette containing the job definition file in a form compatible with the RADSIM computer program. The user then connects the DUI system to the host computer, selects CARDIN TSS subsystem, transfers the contents of the cassette to the TSS current file, and gives the RUN command. The DUI is then disconnected from the host computer.

After the simulation job has been executed, the user connects the DUI to the host computer. Again a question/answer sequence is entered where the system asks the user what is to be plotted and some parameters of the plots. The data generated by the simulation job are then plotted on the CRT display. The CRT display can subsequently be reproduced on paper if the user desires a permanent copy. In addition to immediate plotting, the user has the option of transmitting the contents of the simulation job output file to the DUI for recording on a magnetic tape cassette. The stored data can subsequently be plotted off-line. In addition, the data generated by the host computer can be used as input data for programs executed by the DUI as a stand alone computer system.

K.3 DEDICATED USER INTERFACE HARDWARE

A functional block diagram of the suggested Interactive Radar simulator is shown in Figure K.3-1. The DUI subsystem is indicated by a dashed line. Two hardware designs which satisfy the DUI requirements delineated in paragraph K.2.3 are described in this section. The two designs differ primarily in the minicomputer selected for the communications buffer. Design #1 is configured around a Hewlett-Packard 2100A minicomputer. Design #2 is configured around a Digital Equipment Corporation PDP-11/05 minicomputer. Design #1 offers performance superior to that of Design #2 in every respect, but does so at a higher cost. The details of each design are discussed and a comparison made between them in the remainder of this subsection.

K.3.1 System Design #1

The block diagram of the Design #1 system is presented in Figure K.3-2. The features and parameters of the subsystems which make up this design are discussed in the following paragraphs.

K.3.1.1 Hewlett-Packard 2100A Minicomputer

The HP2100A minicomputer is a user microprogrammable general purpose machine. A summary of the HP2100A parameters is presented in paragraph K.3.3 which compares the HP and DEC minicomputers.

The memory requirements for the HP2100A are determined by the combined size (13K) of the minicomputer Basic Control System (4K), the DUI executive program (3K), and the Simulation Job Setup program (6K). Since memory is supplied in either 8K or 16K increments, the memory size chosen for the minicomputer is 16K.

Eleven Input/Output (I/O) channel slots are required to connect the peripheral devices and special processing modules to the HP2100A. The required I/O interface cards and other processor modules are given by the following list:

1. 12587B EIA RS232 Asynchronous data set interface
2. 12531C Current loop interface to operator's console

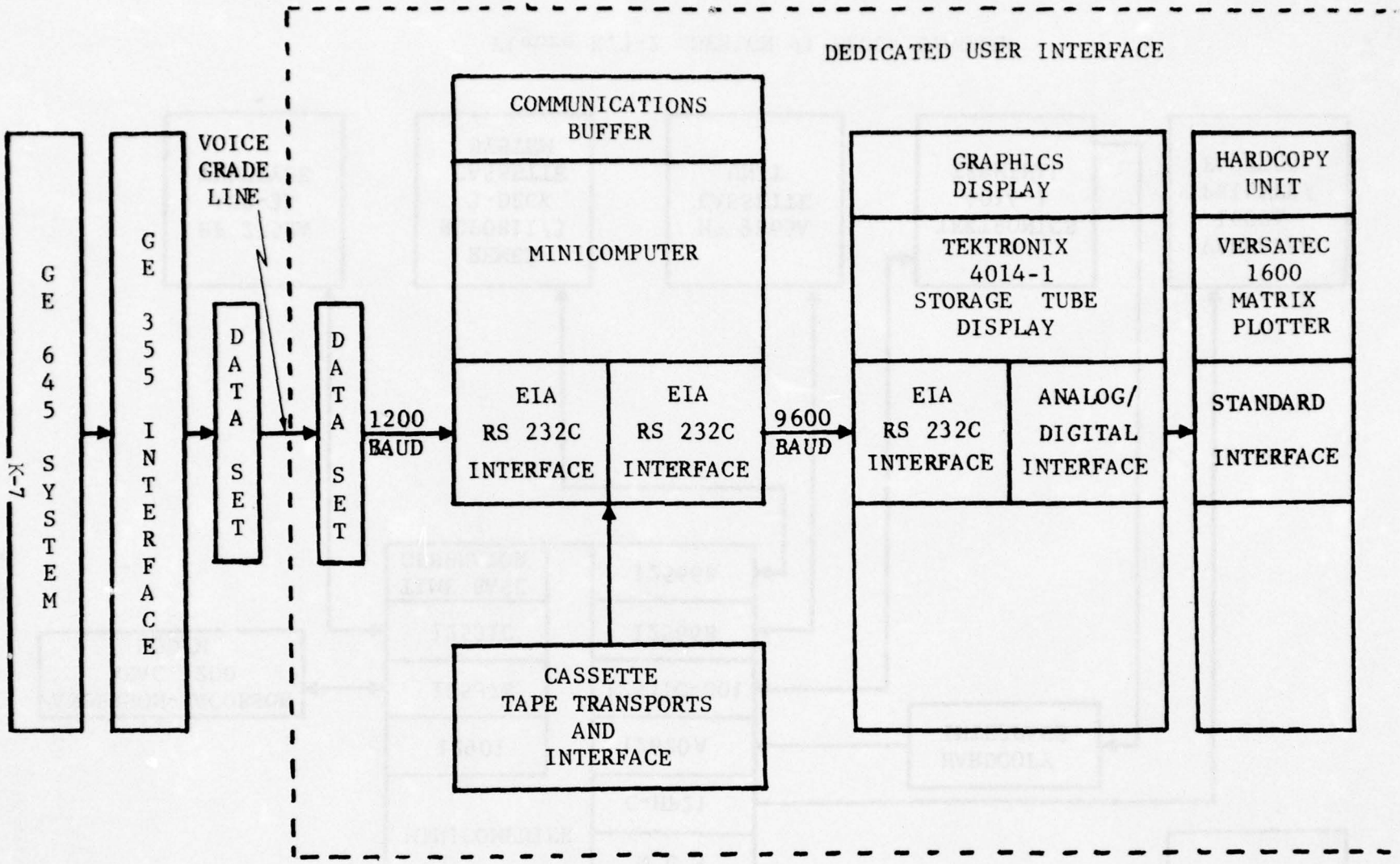

Figure K.3-1 INTERACTIVE RADAR SIMULATOR SYSTEM BLOCK DIAGRAM

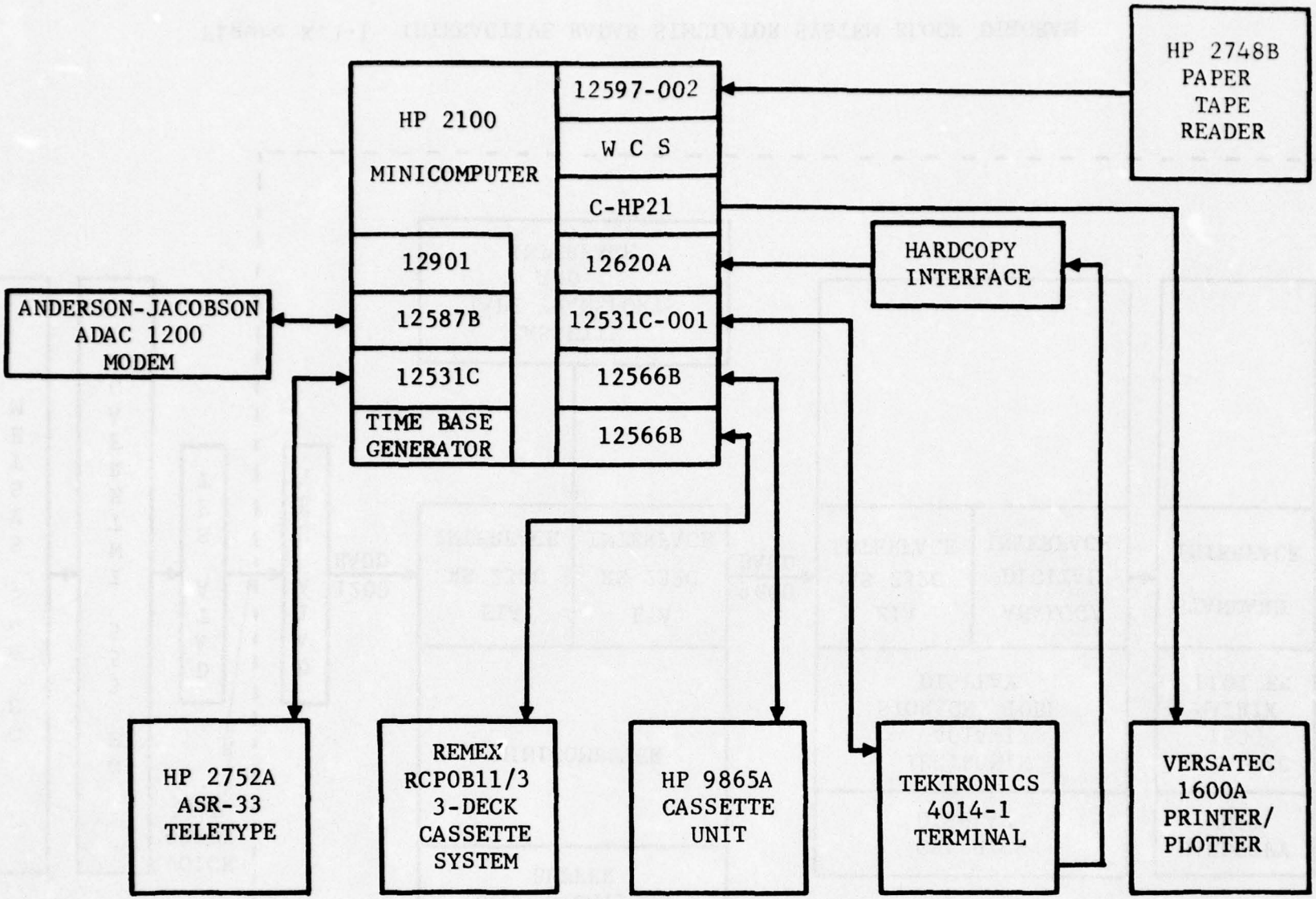

Figure K.3-2 DESIGN #1 BLOCK DIAGRAM

3.	12539C	Time base generator to provide timed system interrupts
4.	12908A	Write control store for user microprogram development
5.	C-HP21	Controller and interface to the Versatec 1600A printer/plotter (this item available from Versatec)
6.	12620A	General Purpose interface to hard copy interface unit
7.	12531C-001	Serial asynchronous interface to Tektronix 4014-1 graphics display
8.	12566B	General purpose interface for fabricating interface to the Remex Cassette system and to the HP9865A cassette memory unit (2 cards required)
9.	12597-002	General purpose interface to the HP2748B paper tape reader
10.	12901A	Floating point hardware.

K.3.1.2 Anderson-Jacobson Modem

The A-J Model ADAC 1200 Data coupler transmits and receives data at 1200 baud over the dial-up telephone network by wires through a DAA or acoustically via a telephone handset. The ADAC 1200 is compatible with the Bell System 202C Data Set.

K.3.1.3 Teletype

Since the Tektronix display is primarily intended to be a simulation data I/O device, an inexpensive teletype was included in the system to act as an operator's console and also to provide a low speed paper tape punch/read capability.

K.3.1.4 Remex Magnetic Tape Cassette

The Remex RCP0B11/3 serves as the bulk storage device of the DUI. By choosing a 3-deck device, one deck can be permanently allocated for operating system and library storage. The remaining two decks will, in general, serve the

same function as the paper tape reader and punch do in other systems. That is, one will normally be the input file to an executing program and the other will be the output file.

K.3.1.5 H-P Cassette Unit

In order to allow data transfer between the DUI system and the RADC HP9820A Calculator system, the following approach will be used. An additional interface for the HP2100A must be fabricated which is capable of driving a HP9865A cassette memory unit. In addition, a new software I/O driver must be written to properly format the data written to the cassette. Once accomplished, this will allow the HP9820A Calculator to read tapes generated by the DUI and vice versa.

K.3.1.6 Tektronix Display

The Tektronix 4014-1 graphics display is the primary device for information interchange between the computers and the user. This display is available with an extended graphics mode which allows 4096 x 3120 points to be plotted on the display viewing area.

The Tektronix 4014 graphics display is based on a direct view storage tube and requires no local mass storage for display refresh. In addition to the store mode, the Tektronix display has a non-store display capability which is called the write-thru mode. Data presented to the user via this mode is not stored on the tube face and appears only as long as the computer commands it to be displayed. Data presented in this mode must be refreshed approximately thirty times per second.

A capability is provided by Tektronix for scanning the storage tube surface and outputting a video signal which is proportional to intensity. This output video can then be processed and printed by the Versatec printer/plotter. The time required to scan the display face is ten seconds.

K.3.1.7 Hard Copy Device

The Versatec 1600A printer/plotter unit will provide for the generation of paper copies of data presented on the Tektronix display. The Versatec printer/plotter is capable of plotting 1600 points across ten inches at the rate of 120 scans/second. In addition to its capabilities as a plotter, the 1600A is useful as a high speed line printer capable of

300 lines/minute. The type font is a 16 x 16 dot matrix. The 96 ASCII character set is standard.

The alternative to specifying the 1600A would be to use the 1600 plotter unit and then perform the ASCII character to dot matrix conversion in the DUI minicomputer. This approach would be more expensive and would increase the processing load on the DUI minicomputer.

The additional one line buffer option is suggested so that a new line of data can be transmitted to the printer/plotter while the previous line is being plotted or printed.

K.3.1.8 Hard Copy Interface Unit

The hard copy interface unit converts the video, produced by scanning the graphics display storage surface, into a digital form suitable for input to the Versatec printer/plotter. The operation of this unit is described in the following paragraphs.

The video from the Tektronix display is passed through a threshold device which outputs a binary "1" if the video exceeds the threshold and a binary "Ø" otherwise. The threshold setting is adjustable so that compensation can be made if video noise level varies. Since the resolution of the Tektronix display is 4096 points and that of the Versatec printer/plotter is 1600 points, a reduction in the resolution of the Tektronix output will be required. Therefore, the output of the threshold must be stretched and then sampled at a rate which corresponds to 4096/3 = 1365 samples per scan line, which is within the capabilities of the Versatec printer/plotter. The sampler output is accumulated in a 16-bit serial in/parallel out shift register. When the shift register is filled, the output word is passed to the minicomputer through a Direct Memory Access (DMA) I/O channel.

In the minicomputer, the incoming data words from the hard copy interface are stored in a buffer area which is 1600 bits in length. After a scan line is loaded into the buffer, the hard copy interface is inhibited for the next two scan lines. This must be done to maintain the geometric fidelity of the Tektronix display in producing the hard copy, i.e. both dimensions are reduced by a factor of three. During the dead time, the Versatec unit will request a new scan line and the buffer will be transmitted to the Versatec at the maximum rate of the DMA channel.

The following is a brief analysis of the data rates anticipated in performing the data transfer from the tektronix graphics display to the Versatec hard copy device. The time required to scan the display face containing 3120 lines is 10 seconds. Therefore, 312 lines per second are transmitted to the hard copy interface. The number of samples taken of one scan line is 1365, therefore the 16-bit word rate out of the hard copy interface is given by the following calculation.

data rate= (1365 samples/line)·(312 lines/sec)/(16 samples/word)

= 26618 words/sec.

This data rate is easily handled by the minicomputer DMA channel which is capable of over 1 million words/second. Since every third scan line from the display is passed to the hard copy device, the scan line transmission rate out of the hard copy interface will be 104 scans/second. The Versatec plotter is capable of accepting up to 120 scans/second.

In producing a hard copy of the Tektronix graphics display, the DUI minicomputer is used simply for buffer storage.

K.3.1.9 Paper Tape Reader

Since Hewlett-Packard software is provided on paper tape a high speed paper tape reader is highly desirable. So an interface should be purchased so that the HP2748B paper tape reader currently in place at RADC (OCSA) can be used with the system.

K.3.2 System Design #2

The block diagram of the Design #2 system is shown in Figure K.3-3. The features and parameters of the subsystems which make up this design are discussed in the following paragraphs. The description of those subsystems which are common to both system designs will not be repeated.

Since the DEC CAPS-11 operating system is resident on the DEC cassette unit, a high speed paper tape reader is not needed in this system.

K.3.2.1 Digital Equipment Corporation PDP-11/05 Minicomputer

The PDP-11/05 minicomputer is a general purpose machine which is widely used in scientific applications. A summary

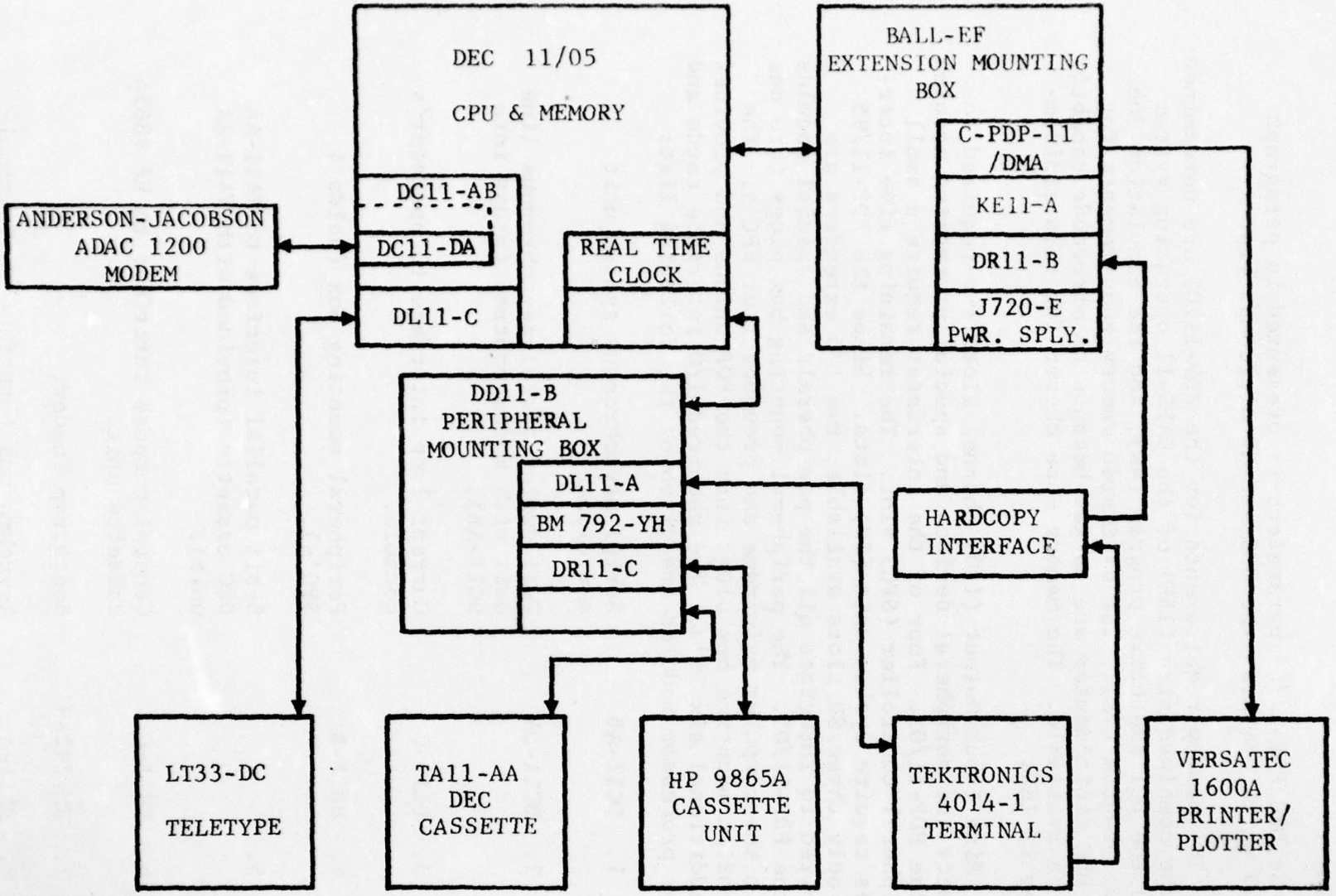

Figure K.3-3 DESIGN #2 BLOCK DIAGRAM

of the DEC PDP-11/05 parameters is presented in paragraph K.3.3 which compares the DEC and HP minicomputers.

The memory requirements for the PDP-11/05 are determined by the combined size (15K) of the CAPS-11 operating system (4K) the DUI executive program (4K), and the Simulation Job Setup program (7K). The estimated memory requirements for the DEC minicomputer are larger because no microcode capability is available. The memory size chosen for this minicomputer is 16K.

Nine Input/Output (I/O) channel slots are required to connect the peripheral devices and special processing modules to the PDP-11/05. Four of the interfaces require a small peripheral controller (SPC) slot. The remaining five interfaces require system unit (SU) slots. Since the PDP-11/95 has only three SU slots available, two I/O extenders are required to interface all the peripherals and special modules to the PDP-11/05. The peripheral mounting box plugs into one SU in the computer mainframe and provides four SPC's. The extension mounting box plugs into the PDP unibus and provides an additional six SU's. The required I/O interface cards and other processor modules are given by the following list:

1.	DC11-AB	Serial asynchronous system unit and clock
2.	DC11-DA	Full duplex serial asynchronous line unit with modem control (plugs into DC11-AB).
3.	DL11-C	Current loop interface to operator's console.
4.	DD11-B	Peripheral mounting box (holds 4 SPC's).
5.		8-bit parallel interface to TA11-AA DEC cassette (provided with TA11-AA unit).
6.	DR11-C	General purpose interface to HP 9865A cassette unit.
7.	BM 792-H	Bootstrap loader.
8.	DL11-A	Asynchronous interface to Tektronix 4014-1 graphics display.

9.	BA11-EF	Extension mounting box (holds 6 SU's)
10.	H720-E	Power supply for BA11-EF
11.	DR11-B	DMA general purpose interface to the hard copy interface unit
12.	C-PDP-11/DMA	Controller and interface to the Versatec 1600A printer/plotter (this item available from Versatec).

K.3.2.2 TA11 DEC Cassette Tape System

The TA11 DEC cassette tape system will serve as the bulk storage device of the DUI.

K.3.3 Comparison of Designs

The important difference between the systems are the minicomputer characteristics, therefore the remainder of this paragraph will consider only the minicomputers. In Table K.3-1, some parameters and capabilities of the two minicomputers are listed. The outstanding differences between the devices are the following:

1. The floating point arithmetic operations of the DEC PDP 11/05 are performed by subroutines and therefore are extremely slow compared to the HP2100A which performs these operations with a combination of hardware and microprogramming.

2. The microprogram in the DEC PDP 11/05 is not accessible to the user. The HP2100A is user microprogrammable. The advantages of microprogramming are: increased speed, reduction of memory space required for the program, and flexibility to adapt the instruction set to a particular application.

3. The DEC PDP 11/05, as configured, can be programmed only in assembly language, whereas the HP2100A can be programmed in FORTRAN II and ALGOL as well as assembly language. The ability to use FORTRAN will significantly reduce the programming task and enhance stand-alone capability.

4. Hewlett-Packard maintains a large library of HP contributed and user contributed programs and micro-

Table K.3-1 HP2100A/DEC PDP-11/05 COMPARISON

	HP2100A	DEC PDP-11/05
Maximum Memory (16 bits/wrd)	32K	28K
Memory Cycle Time (ms)	0.980	0.900
Fixed Point Arithmetic (ms)		
Add	1.96	3.7
Multiply	10.7	4.3
Divide	16.7	4.8
Floating Point Arithmetic (ms)		
Add	24-60	376
Multiply	33-41	1017
Divide	52-56	2169
No I/O Channels	14	3
User Microprogrammable.	Yes	No
Programming Languages	FORTRAN ALGOL Assembly Language	Assembly Language

programs for the 2100 series minicomputers. These programs are available to the user for a small handling charge.

5. The HP2100A is more expensive than the DEC PDP 11/05. The cost of the system configured around the HP minicomputer is approximately 10% higher than the system configured around the DEC minicomputer.

K.4 DEDICATED USER INTERFACE SOFTWARE

The new software to be developed and the modification to be performed on the existing RADSIM computer program are described in this subsection. Before proceeding with the software description, it is felt that the philosophy which guided the allocation of tasks between the DUI minicomputer and the host computer should be discussed.

K.4.1 Allocation of Processing Tasks

The data processing task of the Interactive Radar Simulator is performed by the DUI minicomputer and the H635 host computer. The pertinent factors to consider are:

1. More storage is available in the H635. However, it should be recognized that although the H635 memory is quite large, 256K, the percentage of this available to a particular user during normal working hours is usually less than 25%.

2. The Central Processing Unit (CPU) of the H635 is faster. Although the H635 CPU is an order of magnitude faster than that of the DUI minicomputer, the H635 CPU is time shared by a number of users. Therefore the difference in speed between the dedicated minicomputer and the time shared H635 will probably be less than a factor of three.

3. The data transferred over the phone line should be minimized. Minimizing connect time should be understood to mean not only the problem of obtaining a channel into the time sharing system, but also the latency of the host computer in servicing the TSS user's requests. Experience has shown that the best approach is to move the desired data out of the machine in the quickest possible manner. If binary data (the most compact form) is transmitted to the DUI this will, of course, increase the load on the DUI minicomputer.

4. The DUI minicomputer is dedicated to the performance of one function, whereas the H635 is time shared by a number of users.

5. Since the RADC host computer is already installed, its resources can be considered to have a very low marginal cost and therefore, in configuring a system, it would be prudent to maximize the use of these resources.

In view of the above factors, especially 1, 2, and 5, the portion of the RADSIM computer program which performs the simulation, i.e., the simulation activity, should be executed by the host computer. The function served by the Simulation Data Loader will be moved to the DUI system. By moving the data initialization function to the DUI, all processing of user input data will be done by the minicomputer off-line and the data in a compact form, will then be passed to the host computer over the phone line. This will minimize the amount of data passed over the phone line during job submission.

In the case of the plot programs, the trade offs are not as clear-cut. If minimizing connect time is important, it would be preferable to have the plotter programs executed by the DUI minicomputer with data from the host computer transmitted in binary form. The binary data would then be recorded on magnetic tape cassette and processed for plotting by the DUI minicomputer at a later time. The disadvantage of this approach is that the Tektronix plotter software packages (Terminal Control System (TCS), Advanced Graphics-II (AG-II) and Cal Comp Preview) require more core space than is available in the DUI minicomputer. Therefore, a plotter program executed by the DUI minicomputer could not have all the features provided in the Tektronix software package. An additional advantage of this approach is that since job output data are stored on tape cassette, the data can be reused a number of times in any manner desired by user.

On the other extreme, the simulation output data would be processed by plot programs in the H635. The data transmitted to the DUI would then be in the form of commands to the Tektronix display. The disadvantage of this is that connect time to the host computer will be longer and the data received will be usable by the Tektronix display only. Rather than compromise between these two approaches, the system should be configured such that either technique can be used. If the user wants only a basic plot capability, the plot program in the DUI minicomputer will suffice. For more complicated work, the user will have the full Tektronix software package in the H635 available to him.

In addition to the above, a mode of operation should be included whereby the user can have tabular data transmitted to the DUI under format control and printed by the hard copy device. This will be useful for retrieving tabular output data or program listings. If the user desires only to view the data and requires no hard copy, then the data can be displayed on the Tektronix display. The remainder of the subsection contains a description of the new software to be developed or purchased and the modification to be performed on the existing radar system simulation model.

K.4.2 Communications Buffer Executive

The communications Buffer Executive program (EXEC) executed by the DUI minicomputer serves as a "data traffic cop." The EXEC supervises all input/output operations, provides linkage to job set up routines and plot programs, determines which tasks have the highest priority, handles user requests/answers and system answers/requests.

K.4.3 Radar System Simulation Model

The modifications to be performed on the Radar System Simulation Model (RADSIM) are the following:

1. Develop a new Simulation Data Loader computer program which will accept the job definition file from the DUI system and load the data into a permfile.

2. Modify the existing Simulation Data Loader computer program to write its output data into a permfile instead of to system allocated public disc space. This will be done so that RADSIM can still be available to non-DUI users.

3. Develop a new Data Retrieval computer program which reads simulation output data from permfile, processes it according to mode selected by the user and then transmits the data to the DUI system. The Terminal Control System and Advanced Graphics-II plot programs available from Tektronix should be included in this computer program.

The portion of RADSIM which performs the simulation is unchanged. Therefore, it is not degraded in any way by the addition of the DUI system.

K.4.4 Plot Programs

The programs for converting the simulation output data to a form compatible with the graphics display are available from Tektronix. Some modification of the Tektronix software to be installed on the H635 will be required since it is written for computers having 8-bit bytes and the RADC computer utilizes 9-bit bytes when operating in TSS mode.

The plot program for installation in the DUI minicomputer is also available from Tektronix. This program should require no modification.

The program for generating a hard copy of the Tektronix display will have to be developed. This program will issue commands to the graphics display to start the read scan of the storage surface, accept output data from the hard copy interface and store it in a buffer area, and output the data to the Versatec printer/plotter at the appropriate time.

Since the Versatec printer/plotter is essentially slaved to the Tektronix graphics display for plot hard copy generation there will be no plotter software required for the Versatec printer/plotter.

K.4.5 Simulation Job Setup Program

The computer program for the minicomputer which assists the user in the setting up of a simulation job is, for the most part, composed of four subprograms. These are briefly described in the following paragraphs.

K.4.5.1 Job Setup Controller

This subprogram serves as the supervisor of all operations performed during the job setup procedure. The Job Setup Controller asks questions of the user, accepts and processes the user answers, and passes commands to the appropriate subprograms.

K.4.5.2 Block Diagram Generator

This subprogram processes the information provided by the user and outputs the necessary commands to cause a block diagram to be formed on the graphics display. The user provides the tabular data for identification of modules through

the graphics display keyboard and the positional data for the location of blocks through the graphics display cursors.

K.4.5.3 Job Definition File Generator

The input data to this subprogram is basically the same as that provided the Block Diagram Generator, but the output is in a form that is compatible with the simulation program executed by the host computer. The structure of this data will be the same as the output data from the current Data Initialization activity. The Job Definition File which is the output from this subprogram is written onto a magnetic tape cassette. The tape cassette will then be the user's record of the input data for the simulation to be performed. A pictorial representation of the recommended data structure on the tape is shown in Figure K.4-1. The simulation job represented in this figure is composed of two configurations. The first configuration is to be executed twice for two sets of input data. The second configuration is to be executed only once.

K.4.5.4 RADSIM Catalog and Data Retrieval

As part of the Job Setup Program development effort, all data associated with the RADSIM computer program pertinent to the process of job definition should be cataloged and stored on a tape cassette. During the process of job setup, the user may at any time request that data from this file be presented either on the graphics display in the scratch pad area, or printed on the operator's console.

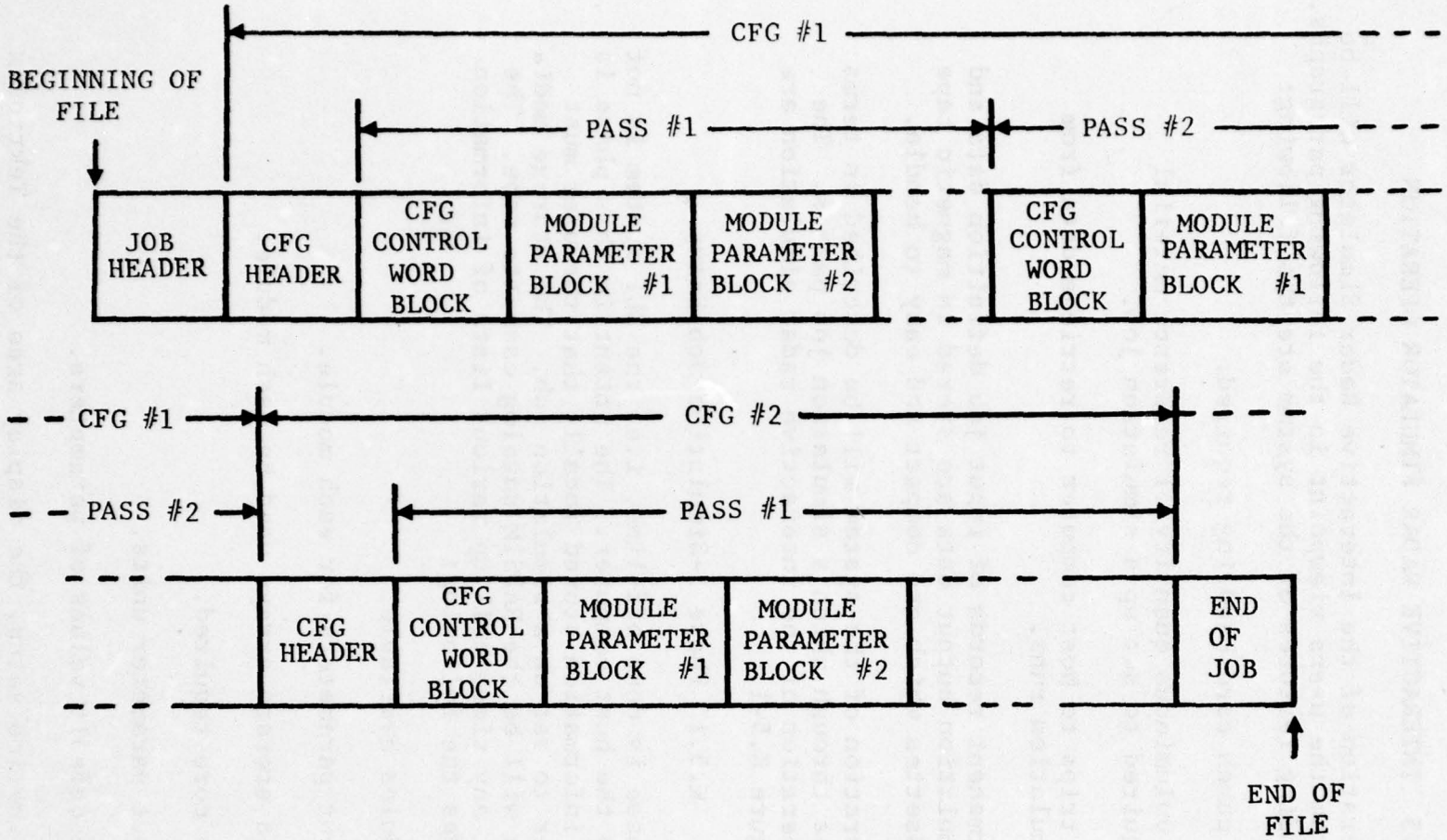

Figure K.4-1 JOB DEFINITION FILE STRUCTURE

K.5 INTERACTIVE RADAR SIMULATOR OPERATION

The operation of the Interactive Radar Simulator will be described from the users viewpoint in the following paragraphs. Four outstanding features of the system are the following:

1. No punch card handling required.

2. No voluminous quantity of reference material required to set up a simulation job.

3. No trips to host computer to retrieve data from simulation runs.

4. Permanent records of input job definition data and simulation output data are stored in magnetic tape cassettes which are compact and easy to handle.

The operation of the system will be described in terms of the phases through which a simulation job passes. The phases of operation of the interactive radar simulation are shown in Figure K.5-1.

K.5.1 Phase I-Simulation Job Setup

This phase is done off-line, i.e. the DUI system is not connected to the host computer. The intent in this phase is to have all information stored locally that the user must know in order to set up a simulation job. The storage media for the data will be the RADSIM catalog cassette tape. The user can, at any time, call up various lists of information which includes the following:

1. Modules available.

2. Input parameters for each module.

3. Data storage arrays used by each module.

4. The core required.

5. Input parameter units.

6. The default values of parameters.

During the job setup, the display area of the Tektronix graphics display is divided into two areas, a scratch pad

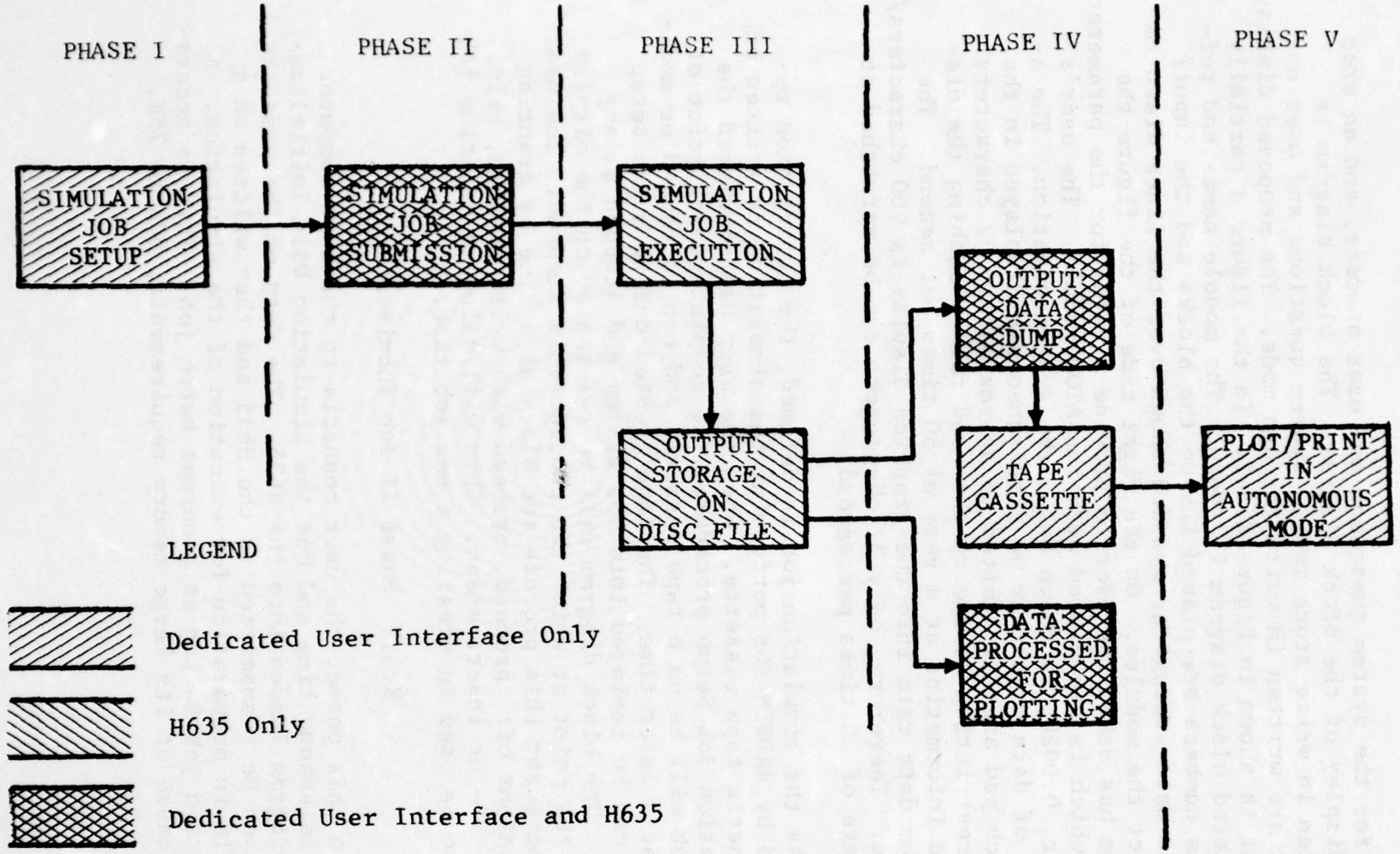

Figure K.5-1 INTERACTIVE RADAR SIMULATOR FUNCTIONAL BLOCK DIAGRAM

area for the system questions and user answers, and an area for display of the block diagram. The block diagram is written in write store mode. System questions and user answers are written in write-through mode. The proposed display layout is shown in Figure K.5-2. In the figure a partially completed block diagram is shown. The module names and reference numbers are placed inside the blocks and the input/output data storage arrays are shown over the lines drawn to connect the modules. On the right side of the figure the system has asked the user to provide a value for the parameter, LSB, which is associated with the ATOD module. The user's answer, 0.0020, is shown below the system question. The amount of data which can be simultaneously displayed in the scratch pad area is limited to approximately 32 characters. This restriction is due to the need for refreshing the displayed information at a rate of 30 times per second. The maximum data rate into the graphics display is 960 characters/second. Therefore, only 32 characters can be refreshed at the rate of 30 times per second.

As the simulation job is defined, the information required by RADSIM for performing the simulation is written on a magnetic tape cassette. When the user has completed the Simulation Job Setup procedure, the complete description of the job will be on a tape cassette and can be reused or modified at a later time. The tape created during a job setup phase can be replayed into the system and stopped at any point. The block diagram will be re-created on the display up to the point at which the procedure is stopped. The user may increment this process one block at a time by granting permissions of: proceed, proceed with write through, skip, substitute or insert steps. This will allow an existing job tape to be used in creating a new job tape.

K.5.2 Phase II-Job Submission

In this phase, the user connects to the host computer via a telephone line and has the Simulation Data Initialization program loaded into the H635. The data on the cassette will then be transmitted to the H635 and then written on a permfile in preparation for execution of the simulation. A simulation job is run as a normal batch job. This is necessary because of its large memory requirements, 60K to 75K.

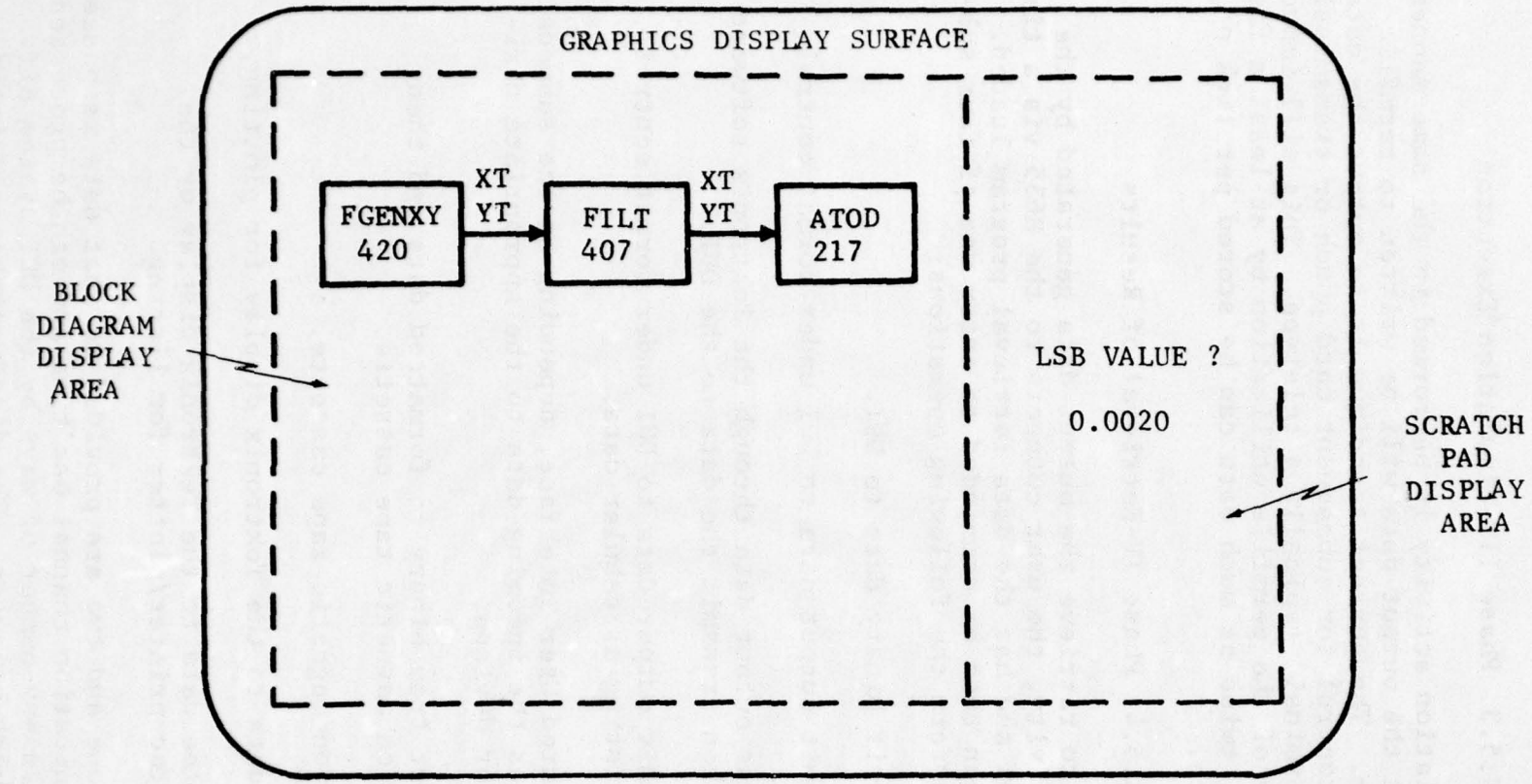

Figure K.5-2 DISPLAY DURING SIMULATION JOB SETUP

AD-A031 480 GENERAL DYNAMICS FORT WORTH TEX CONVAIR AEROSPACE DIV F/G 17/9
ENDO ATMOSPHERIC-EXO ATMOSPHERIC RADAR MODELING. APPENDICES, A---ETC(U)
JUN 76 R J HANCOCK, F H CLEVELAND F30602-73-C-0380
UNCLASSIFIED RADC-TR-76-186-VOL-4-PT-1 NL

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K.5.3 Phase III-Simulation Execution

The simulation activity is performed in the same manner as now, except the output data will be written to permfile in binary form. The current technique is to output the data under format control for subsequent card punch or transmission to a remote terminal, typically a teletype. This will improve the efficiency of the permfile utilization by at least a factor of 2, i.e. twice as much data can be stored per link of disc file space.

K.5.4 Phase IV-Retrieval of Results

In order to retrieve the output data generated by the simulation activity, the user connects to the H635 via a time sharing channel and has the data retrieval program loaded. This program can then be commanded to enter one of four submodes which perform the following operations:

1. Transmit binary data to DUI.

2. Transmit output data to DUI under format control.

3. Process output data through the Tektronix software and then transmit the data to the DUI.

4. Transmit output data to DUI under format control for listing as tabular data.

The Dedicated User Interface, depending on the submode selected, passes the incoming data to the appropriate peripheral device or devices.

1. Convert from binary to formatted data and then store on magnetic tape cassette.

2. Store on magnetic tape cassette.

3. Pass data to the Tektronix display for plotting.

4. Pass the data to the Tektronix display or the Versatec printer/plotter for listing.

Submodes one and two are provided so that data is passed over the communication channel one time and can be processed and displayed in any number of ways by the DUI system off-line from the host computer. The disadvantage associated

with this is that the DUI plot programs will not have as much capability as the H635 plot programs.

K.5.5 Phase V-Autonomous Operation

In addition to serving as the user's interface of the Interactive Radar Simulator, the DUI system can be operated as a stand-alone minicomputer system. RADC personnel who are familiar with FORTRAN can easily make the transition to the computer system configured about the 2100A, i.e. the Design #1 system. The transition to the DEC 11/05 offered in Design #2 will not be as simple since the DEC system will not support a FORTRAN compiler and must therefore be programmed in assembly language. The following two items available from Hewlett-Packard would significantly enhance the stand-alone capabilities of the Design #1 system:

HP12907A - Fast FORTRAN Processor (Scientific Instruction Set). This board plugs into an I/O slot and provides 13 microcoded subroutines which greatly enhance the through-put efficiency of FORTRAN and other high level languages.

HP12892A - Memory Protect Fence. This board plugs into the memory section and aids the operating system in running multiple programs.

The addition of a 7 or 9 track magnetic tape transport or a disc subsystem should be considered if the number of autonomous progressing jobs are sufficient to justify the cost.

APPENDIX L

RADAR CROSS SECTION

ANALYTIC MODEL DESCRIPTIONS

Published in Part 2 of this volume.

APPENDIX M

HEWLETT PACKARD 9820A COMPUTER PROGRAM FOR PLOTTING FILTER TRANSFER FUNCTIONS

M.1 INTRODUCTION

The S-domain transfer function for a general filter can be represented by the ratio of two polynomials as shown in the following expression

$$H(S) = \frac{(S-Z_1)(S-Z_2)(S-Z_3) \ldots (S-Z_{NZ})}{(S-P_1)(S-P_2)(S-P_3) \ldots (S-P_{NP})} \cdot SF$$

where:

Z_i represents the i^{th} complex zero,

P_i represents the i^{th} complex pole and

SF is a scale factor.

The frequency units used in the expression above can be any frequency; i.e., KHz, MHz, GHz etc. as long as all inputs are consistent in the same units.

M.2 PROGRAM OPERATION

The filter program plots the baseband filter impulse response based on normalized pole-zero locations. The program can be used to plot magnitude in either voltage vs. frequency or power in dB vs. frequency. The theory of operation is shown on page 4-61 of the RADSIM report Vol. II, Part 1. The following are the user supplied inputs required by the program:

1. BYPASS - Flag set to zero or one; a value of one indicates that the user desires to key in the plot parameters such as frequency range and magnitude of impulse response for plotting; a value of zero indicates that the previous set of plot parameters are to be used for the next plot.

2. FSTART - Starting frequency for plot (frequency Hz, KHz, MHz, etc.)

3. FSTOP - Ending frequency for plot (frequency Hz, KHz, MHz, etc.)

4. LOG PLOT - Flag set to zero or one; zero indicates the magnitude of the impulse response will be plotted in units of voltage vs. frequency; one indicates a plot of dB power vs. frequency.

5. TOP - Maximum magnitude to be plotted (volts or dB).

6. BOTTOM - Minimum magnitude to be plotted (volts or dB).

7. INPUT - Flag set to zero or one; zero indicates use same pole zero locations as for previous plot; one indicates that new pole zero locations are to be entered.

8. NO. POLES - Number of poles to be entered.

9. NO. ZEROES - Number of zeroes to be entered.

10. SCALE - Scale factor: used to normalize magnitude of impulse response to unity.

11. POLE-R - Real part of complex pole.

12. I - Imaginary part of complex pole.

13. ZERO-R - Real part of complex zero.

14. I - Imaginary part of complex zero.

Once all the required input data has been supplied by the user, the filter impulse response is plotted; however, no axes will be drawn or labeled. All inputs are listed on the HP9820 calculator printer so that the user may label the plot if desired. Tables of normalized pole-zero locations for Chebyshev filters are listed in Volume IV, Part 1, Appendix E.

M.3 SAMPLE PROBLEM

The following sample problem will be a plot of the impulse response of a six pole Chebyshev filter with 0.1 dB ripple. The HP9820 calculator printer listing which shows user supplied inputs is shown in Figure M.3-1.

The output impulse response plotted in volts vs. frequency is shown in Figure M.3-2 and in dB vs. frequency is shown in Figure M.3-3. The axes and labels have been done by the user based on the input listing shown in Figure M.3-1.

M.4 HOW TO USE THE FILTER PROGRAM RESULTS WITH RADSIM

The primary purpose of running the filter program is to generate accurate input data for RADSIM and in particular for Module FILT in RADSIM. This subroutine simulates a continuous filter which is defined by an S-domain polynomial transfer function.

When executing *FILT*, the user must use the impulse response in terms of voltage vs. frequency. The amplitude must be normalized to unity gain and the pole-zero locations must be modified to reflect the desired bandwidth of the filter to be used in the simulation job.

Suppose the input job stream, for this example, has been set up to reflect consistent frequency inputs in gigahertz (GHz) and time inputs in nonoseconds (ns). The frequency scale in Figures M.3-2 and M.3-3 is now constrained to units in GHz. Suppose that the desired six-pole Chebyshev filter with 0.1 dB ripple has a 3 dB bandwidth of 50 MHz and unity gain at the peak of the impulse response. The following procedure would be used to modify the pole-zero locations to reflect the desired 50 MHz 3 dB bandwidth and to calculate a scale factor (SF) to normalize the peak of the impulse response to unity. In Figure M.4-1 the 3 dB bandwidth extends from -1 GHz to +1 GHz. If a lowpass filter is to be simulated, the 3 dB bandwidth would extend from DC (0 frequency) to 1 GHz; however, for a bandpass filter, the bandwidth will be measured symmetrically about zero. To modify the pole locations, the following procedure is used.

```
1→N
 1 00000                    BYPASS
-3→R45
-3 00000                    FSTART
3→R46
 3 00000                    FSTOP
 1→R47
   10000                    FI
0→R70
 0 00000                    LOG PLOT
2
10→R54
10 00000                    TOP
0→R55
 0 00000                    BOTTOM

FI,T
6→R43
 6 00000                    NO. POLES
0→R44
 0 00000                    NO. ZEROES
1→R51
 1 00000                    SCALE
19
- 10494112→R31
 - 10494                   Real part of first complex pole
 .96668431→R(2+1)
⊢
   96668                    Imaginary part of first complex pole
 2 00000
19
- 10494112→R71
 - 10494
- .96668431→R(2+1)          }2nd complex pole
⊢
 - .96668                  }
 4 00000                   }
19
- 28670446→R21              }
 - 28670                   }
 .70766203→R(2+1)          }3rd complex pole
⊢
   70766                   }
 5 00000                   }
```

Figure M.3-1 HP9820 LISTING SHOWING FILTER PROGRAM INPUTS

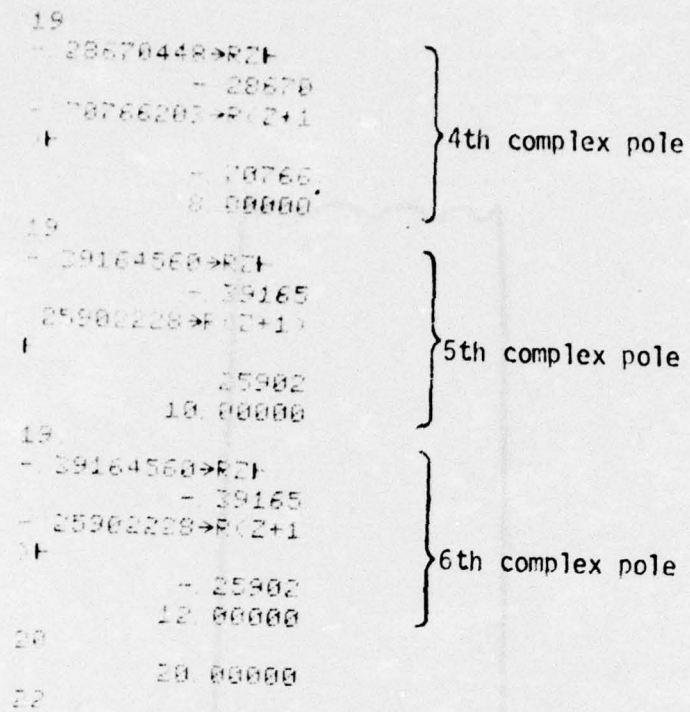

Figure M.3-1 HP9820 LISTING SHOWING FILTER PROGRAM INPUTS (Cont.)

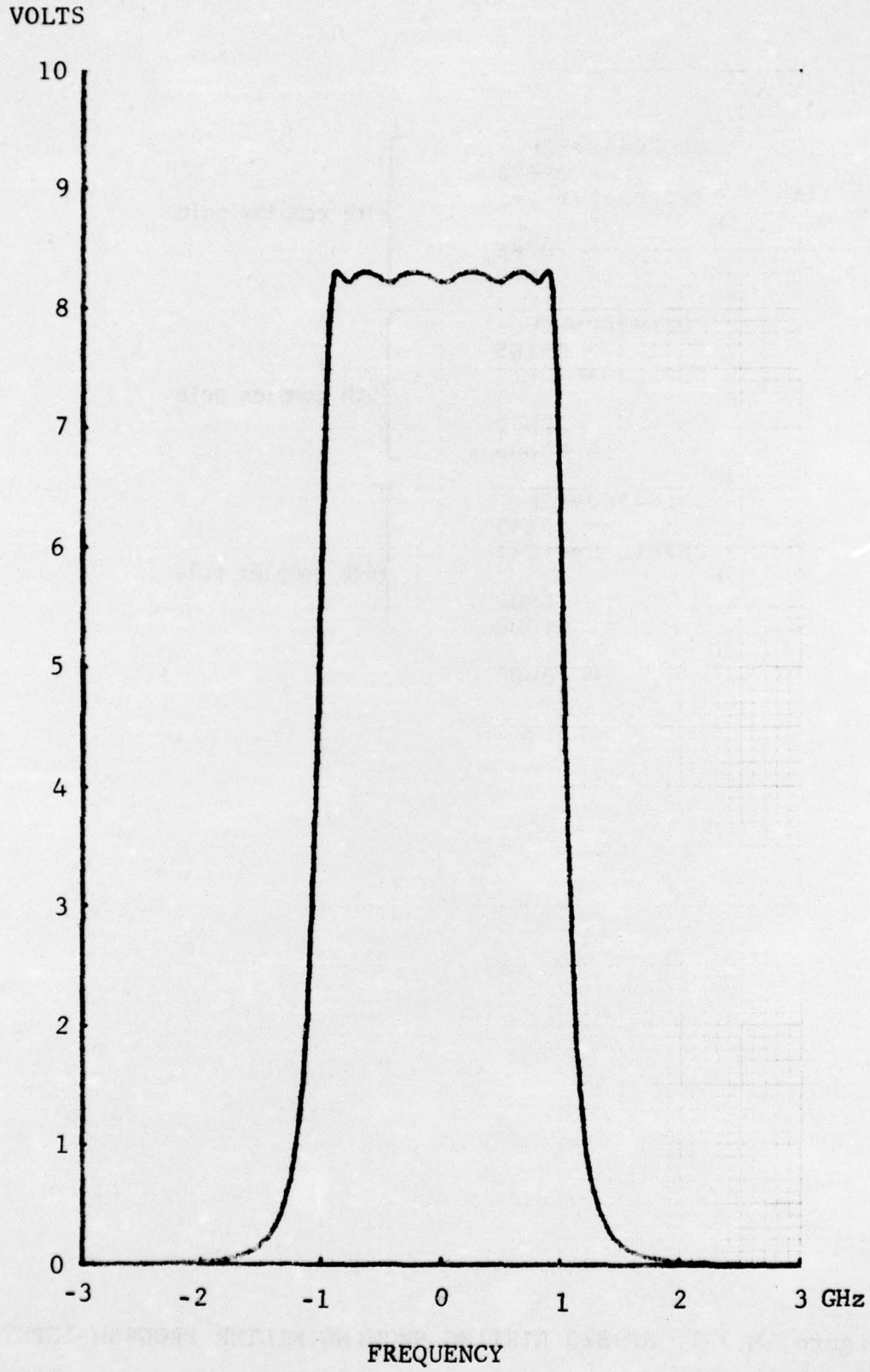

Figure M.3-2 6-POLE CHEBYSHEV FILTER, 0.1 dB RIPPLE

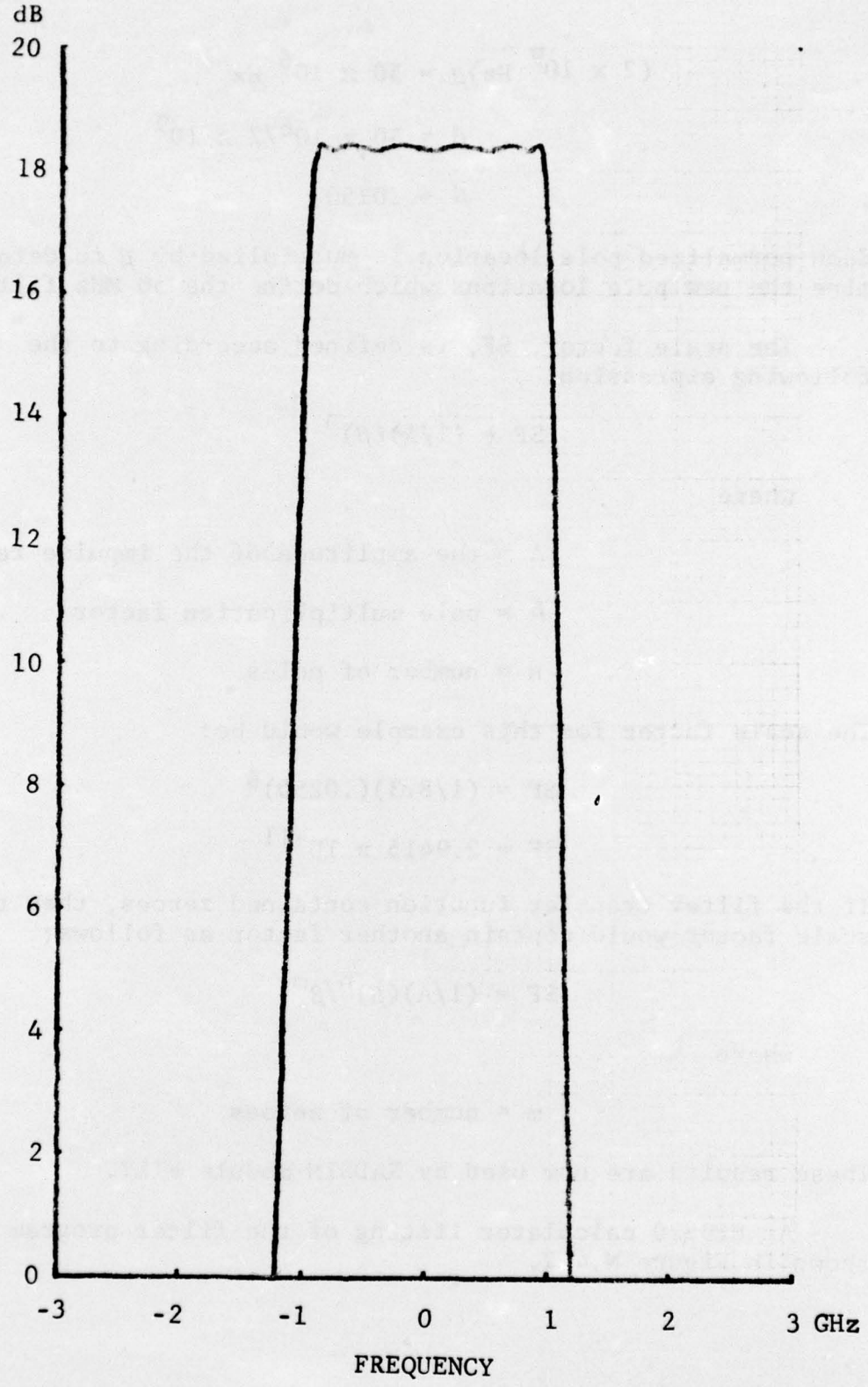

Figure M.3-3 6-POLE CHEBYSHEV FILTER, 0.1 dB RIPPLE

$$(2 \times 10^9 \text{ Hz})\beta = 50 \times 10^6 \text{ Hz}$$

$$\beta = 50 \times 10^6 / 2 \times 10^9$$

$$\beta = .0250$$

Each normalized pole location is multiplied by β to determine the new pole locations which define the 50 MHz filter.

The scale factor, SF, is defined according to the following expression.

$$SF = (1/A)(\beta)^n$$

where

A = the amplitude of the impulse response

β = pole multiplication factor

n = number of poles

The scale factor for this example would be:

$$SF = (1/8.3)(.0250)^6$$

$$SF = 2.9415 \times 10^{-11}$$

If the filter transfer function contained zeroes, then the scale factor would contain another factor as follows:

$$SF = (1/A)(\beta)^n/\beta^m$$

where

m = number of zeroes

These results are now used by RADSIM module FILT.

An HP9820 calculator listing of the filter program is shown in Figure M.4-2.

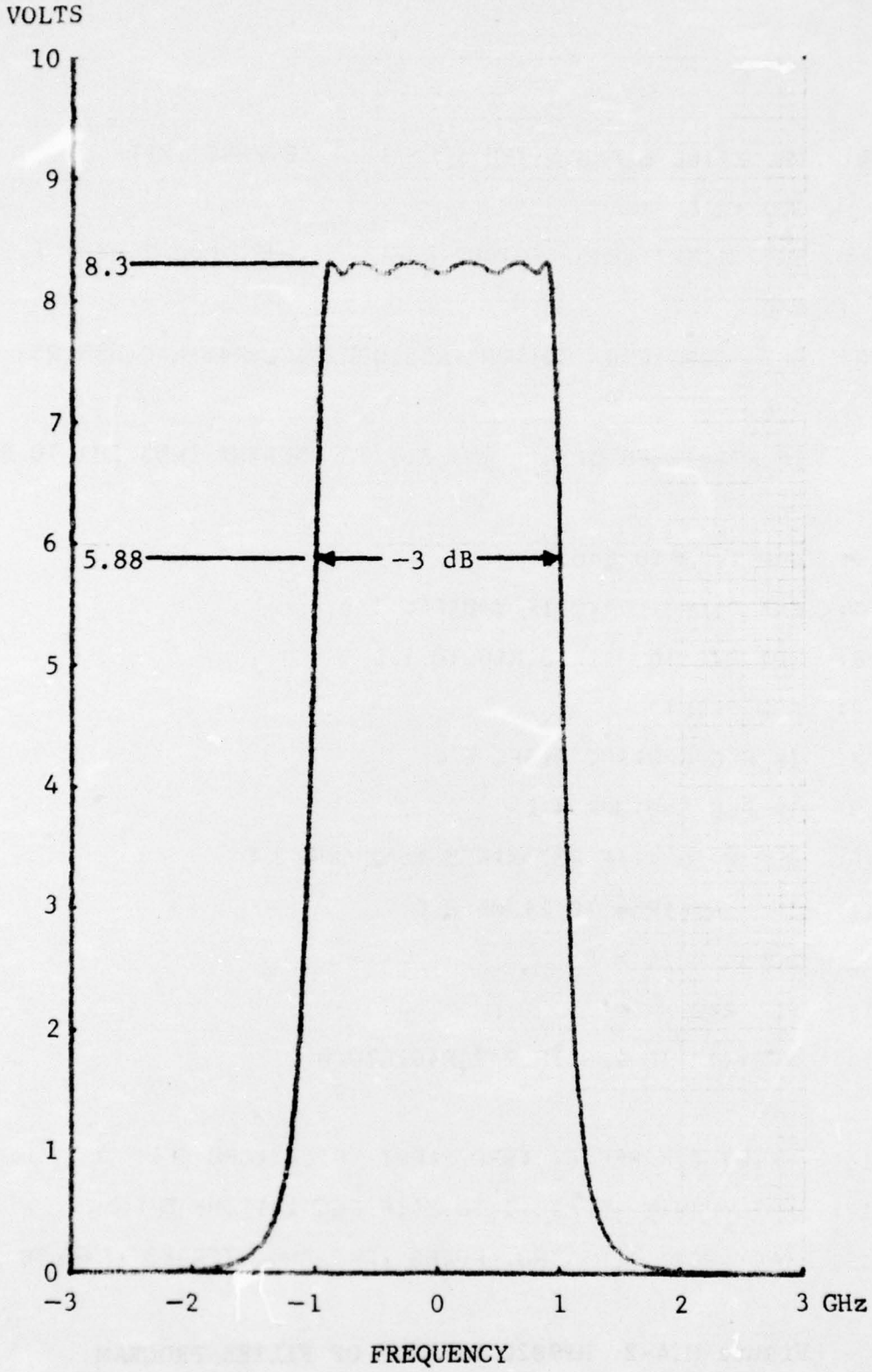

Figure M.4-1 6-POLE CHEBYSHEV FILTER, 0.1 dB RIPPLE

```
0:  TBL 2;TBL 6;FXD 5;TRC ;PEN ;ENT "BYPASS";X;IF X=0;
    GTO +3 [
1:  ENT "FSTRT",R45,"FSTOP",R46,"FI",R47,"LOG PLOT ?",
    R70 [
2:  ENT "TOP",R54,"BUTTOM",R55;NOR ;SCL R45,R46,R55,R5
    4 [
3:  IF R70=1;SFG 5;TN↑ (R54/20) TO R56;TN↑ (R55/20) TO R57
     [
4:  NOR ;R45 TO R48 [
5:  ENT "INPUT ?",Y;IF Y=0;SFG 1 [
6:   PI R48 TO A;1 TO X;0 TO Y [
7:  GSB "FILT" [
8:  IF FLG 6=0;SPC 3;SFG 6 [
9:  IF FLG 5=0;JMP 4 [
10: ABS X TO X;IF R57>X;R55 TO X;JMP 3 [
11: IF X>R56;R54 TO X;JMP 2 [
12: 20LOG X TO X [
13: PLT R48,X [
14: R48+R47 TO R48;IF R48>R46;GTO 0 [
15: GTO 6 [
16: "FILT";IF FLG 6=0;SPC 2;PRT "FILT";SPC 1 [
17: X TO R49;Y TO R50;0 TO Z;IF FLG 1=1;JMP 5 [
18: TRC ;SFG 1;ENT "NO. POLES",R43,"NO. ZEROES",R44,"S
```

Figure M.4-2 HP9820 LISTING OF FILTER PROGRAM

```
19:  ENT "POLE - R";RZ;"I";R(Z+1);Z+2 TO Z;JMP Z=2R43 [
20:  20 TO Z;JMP (R44=0)+1 [
21:  ENT "ZERO - R";RZ;"I";R(Z+1);Z+2 TO Z;JMP Z=2R4. ?0 [
22:  NOR ;0 TO C TO Z;1 TO B;IF R43=0;JMP 3 [
23:  -RZ TO X;R48-R(Z+1) TO Y;GSB "POL" [
24:  B/X TO B;C-Y TO C;Z+2 TO Z;IF 2R43>Z;JMP -1 [
25:  20 TO Z;IF R44=0;JMP 3 [
26:  -RZ TO X;R48-R(Z+1) TO Y;GSB "POL" [
27:  XB TO B;C-Y TO C;Z+2 TO Z;IF 2R44>Z-20;JMP -1 [
28:  BR49R53 TO X;C+R50 TO Y;RET  [
29:  "POL";IF Y=0;ABS X TO X;RET  [
30:  IF X=0;ABS Y TO X; PI Y/2X TO Y;RET  [
31:  ATN (X/Y) TO R52; SQR (XX+YY) TO X;R52 TO Y;RET  [
32:  END  [
```

Figure M.4-2 HP9820 LISTING OF FILTER PROGRAM

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